UNIVERSITY OF MICHIGAN
MAR 23 1956
FORESTRY LIBRARY

LATIN AMERICA

WORLD CROPS

embracing

AGRONOMY, HANDLING, PROCESSING, STORAGE AND PROTECTION SOILS, CHEMICALS, IRRIGATION, ENGINEERING AND ECONOMICS

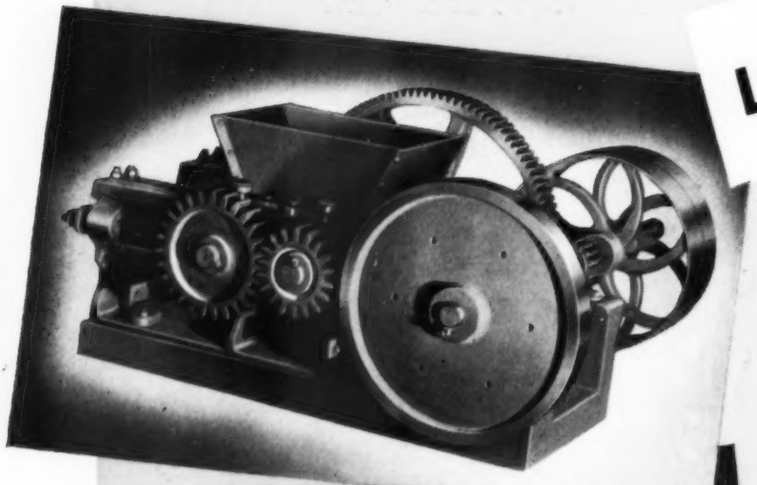
VOLUME 8, No. 3 **MARCH 1956**

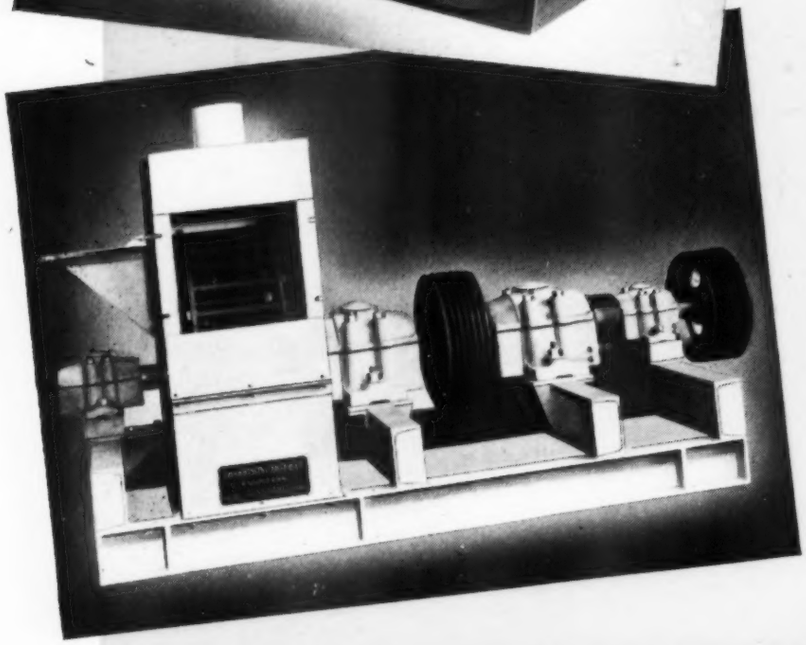
A Publication of The Leonard Hill Technical Group

Rotavation of Sugar Cane in Cuba

CRUSHING?
GRINDING?

LEAVE IT TO US!





Our research and development organisation is always ready to tackle your particular job. If you have a crushing or grinding problem, consult J. Harrison Carter—we've been experts in this field for over half a century.

J. Harrison Carter offer a wide range of DISINTEGRATORS, CRUSHERS, GRINDERS, MIXERS, EDGE RUNNER MILLS. Machinery for manufacturers of: Agricultural Chemicals, Bone Meal, Bone Flour, Animal Feed.

Top: Heavy Duty Crusher
Left: Bar Type Disintegrator

J. Harrison Carter Ltd
DUNSTABLE · BEDS · ENGLAND
TELEPHONE · DUNSTABLE 1191/2

WORLD CROPS

Vol. 8, No. 3

CONTENTS

MARCH 1956

EDITORIAL COMMENT:
Farm Accidents: An Agricultural Revolution: This Issue: Cause for Complaint: Nitrogen and Legumes: A Miracle Machine: New U.S. Policy: Farming—and Steel Centenary: Hungarian Irrigation 95

Soya-bean Adaptation in Sweden—*Sven A. Holmberg* 99

A Farm Service in Venezuela 104

A Successful Bahamian Venture: A note from the Island of Eleuthera 107

The Rupununi Savannahs—*C. H. Brown*, B.SC. 109

Subsistence Farming in the Rupununi Savannahs—*Edwina Melville* 110

Note on Agriculture in Latin America 112

Agricultural Crops in Hawaii: II—*Alan Thistle* 114

New Publications 120

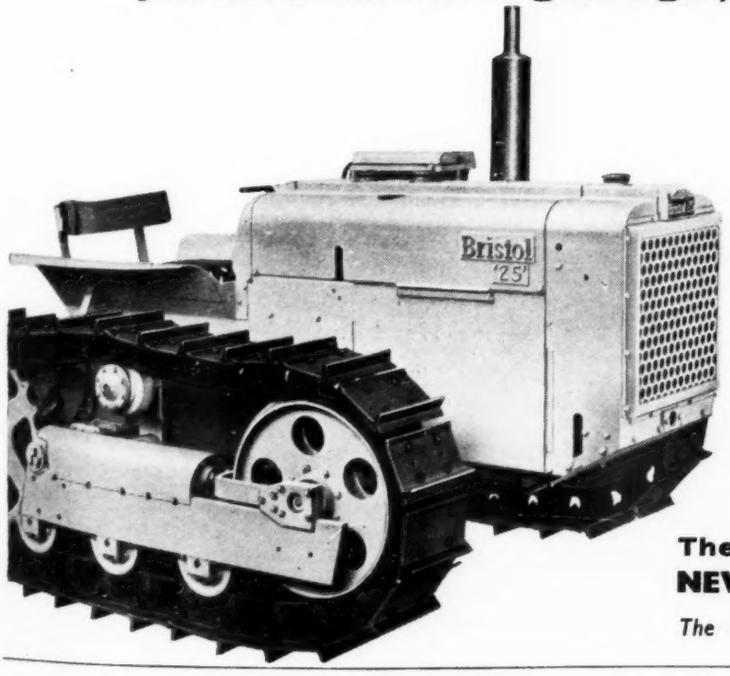
Machinery and Equipment 122

World Crop Reports 125

Published monthly by Leonard Hill Limited, Stratford House, 9 Eden Street, London, N.W.1, England (Tel. Euston 5911)

Your land hilly? Grow row-crops? Reclaiming?

—you need this NEW lightweight, power-packed crawler



Work slopes that no wheeled tractor can tackle—in complete safety—up and down, *and across*—with this new, better Bristol '25'. The *new* Bristol '25' does every on-the-farm job. Its 2-ton drawbar pull makes light work of two- and three-furrow ploughing, land clearing, timber extraction—every job that calls for real power. Its manœuvrability and accurate steering make it equally useful in close, row-crop work. This powerful *new* crawler has all-steel, trouble-free tracks, ground pressure of only 4½ lbs. per sq. in., economical Diesel or V.O. engine, etc. Write at once for free, fully-illustrated catalogue.

The NEW BRISTOL '25'

The lightweight crawler with the heavyweight pull

BRISTOL TRACTORS LIMITED · EARBY · VIA COLNE · LANCASHIRE

After Coffee...

TEA

Before Ceylon became famous for its tea—it was famous for its coffee. Early in the 1800s the steep green slopes of the island's hill jungle were cleared and cultivated by coffee planters, mostly Scots, and coffee soon became the major crop. Then in 1869 came disaster: a devastating blight attacked the trees and within a few years the whole industry was wiped out. So the resourceful Scots planted tea instead ....

But the tea bushes of Ceylon have constantly to be protected against diseases — among them Blister Blight. Here the problem was not to find a fungicide — a copper compound was known to be effective — but to develop a technique of spraying the bushes so that the fungicide could penetrate and do its job. Plant Protection Ltd was called in and, in collaboration with the Tea Research Institute, they evolved a technique of low-volume spraying which proved completely satisfactory.

Devising new spraying techniques is only part of the Plant Protection service to farmers and growers.
The real basis of this service is the research on fungicides, insecticides and weedkillers carried out by the parent Company, Imperial Chemical Industries Limited, and at Plant Protection's Fernhurst Research Station. This ensures that Plant Protection products are as effective and reliable as modern science can make them.

PLANT PROTECTION LTD

Editorial Comment

Farm accidents

AN analysis of agricultural accidents by Mr. H. F. King, of the Nuffield Foundation research unit into problems of ageing, shows that the proportion of injuries to farm hands from falls and blows from falling or moving objects increases as the men get older. On the other hand, young farm workers suffer more from injuries caused by machinery or inflicted by the tools they handle. The younger employees' injuries are usually connected with an accident on the job in hand and affect the part of the body which is being used. Older employees suffer more from accidents which are not connected with the job they are doing at the time and which injure some other part of the body. Cuts, lacerations, burns and scalds are fewer among the older men. Broadly, the reasons seem to be that skill in handling equipment increases with age but quickness of reaction to sudden movements declines; nevertheless, the liability to particular kinds of accidents must be taken into account—the younger men suffer more from injuries when starting an engine because tractor drivers are usually comparatively young. Inquiries among factory workers show a decline in punctured wounds as the men increase in age and experience. There is no such change with age among agricultural workers, whose punctured wounds are mostly from thorns.

Mr. King enlarges on the subject in the journal entitled *Occupational Psychology* at a time when the whole subject is receiving attention. Responsible New Zealand and Australian agricultural journals have dealt fully with the subject of accident prevention and in Britain the Agriculture (Safety, Health and Welfare Provisions) Bill, published recently, provides for securing the safety, health and welfare of persons employed in agriculture (including forestry).

An agricultural revolution

THE recently published report of the Welsh Agricultural Land Sub-Commission on some 290,000 acres in Eastern Cardiganshire, Southern Montgomeryshire and Northern Radnorshire declares that the development of farm mechanisation, motor transport and the increasing demand for modern amenities, such as electricity and water supply, are bringing about rapid changes, amounting to an agricultural revolution, so that the pattern of agriculture is changing with the abandonment and absorption of many of the smaller and more remote holdings.

The great majority of the farm units in the area are economically unstable as a result of inadequate size, lack of public services and remoteness from community life, say the Sub-Commission. They point out further that the social and economic fabric of the countryside has been weakened by the concentration of industries in towns and the consequent disappearance of rural craftsmen. The Sub-Commission advocate, in general, larger units and more compact human settlements, which can more economically be provided with services.

Cattle and sheep rearing is the predominant farming activity in this area. The report recommends that if economic production is to be achieved and the standard of living of the occupiers and their workers raised larger units will be needed. Although, of course, it is difficult to generalise in view of the varying quality of the soil, the report suggests that a hill farm in the area needs about 100 to 150 acres of enclosed land run with 500 acres of rough grazing, whereas on medium-quality land a livestock-rearing unit needs at least 200 acres of enclosed land. Dairy holdings in the valleys need from 100 to 150 acres to form an economic unit. However, it is evident that some form of compensation or other incentive will be needed to facilitate the transition from small to larger units. The Sub-Commission envisage that a number of smallholdings in favourable situations will continue to be occupied on a part-time basis by rural workers.

It is not possible to say what the cost of providing fixed equipment would be under the new pattern of ownership, nor is it possible to forecast with accuracy what increased production would result from the provision of extra equipment. Although it is estimated that £2,300,000 would be needed to rehabilitate the farms in the area in their existing pattern, the sum would be less if the units are increased in size. The formation of larger units would not lead to an increase in production over the area as a whole, at least for some time, but there would be a saving in labour and capital equipment.

The report recommends that the Minister of Agriculture, Fisheries and Food should, as basic services are developed, consider the introduction of rationalisation grants to equip larger units emerging from the process of amalgamation of small uneconomic units. In particular, the Sub-Commission advocate the sponsoring by the Ministry of the production of multi-purpose prefabricated buildings, the provision of a contract service for the improvement of farm roads and farmyards, and assistance for the improvement of farm houses.

The report also recommends that priority should be given to the provision of basic services, *i.e.* public roads, water and electricity supplies; that machinery should be set up to co-ordinate development of the rural areas;

that an experimental hill farm might be established; and that the present grants and subsidies should be reviewed to further the type of reorganisation suggested in the report. Recommendations are also made that cottages at low rents should be provided for retired farmers so as to encourage the amalgamation of poor units occupied by them. The provision of further housing accommodation at low rents for farm workers is also considered to be necessary.

This issue

OWING to a dispute between the British Federation of Master Printers and the Typographical Association (one of the printing trade unions), which will affect the publication of periodicals in England and Wales, the number of pages in this issue of WORLD CROPS has had to be curtailed. This means that several articles that were scheduled to appear have had to be held over but they will be published as soon as possible.

Cause for complaint

THERE is an annual economic report issued by the Ministry of Agriculture. The most recent was the seventh in the series, ' Farm Incomes in England & Wales, 1953–54 ', (H.M.S.O., 7s. od. net). Soon after it emerged, practically every British newspaper carried headlines such as ' Farm Incomes Rise by 22½% ' etc. The general effect of this upon a public which is largely ill-informed on either farming or economics is deplorable. How many newspaper readers who saw these headlines read the paragraph or two below them? How many of those who did read the accompanying text appreciated the difference between *farm* income and *farmer's* income, between revenue and margin of profit? It is probable to the point of certainty that a huge majority of urban inhabitants of the U.K. quickly jumped to the conclusion that the ' always-grumbling ' farmers had caught the rest of the country ' again ', that their earnings had gone up by nearly one-quarter. Food being dearer, farmers have done better. With huge sums taken from tax-payers to support agreed price-levels, farmers who pretend to be poor are in fact waxing richer than ever. Of course far too many factory and office workers thought this—or worse.

For this the title and economic terminology chosen for the annual official publication must take the main share of blame. To trained economists ' income ' may be the proper term, but to most ordinary citizens it means, and always has meant, the annual sum of money one earns, the total £ s. d. available for personal needs, saving etc. Further blame must be borne by the many newspapers whose reports made little or no effort to explain that expenditure upon farming necessities had also risen, that ' profit '—the difference between revenue and costs—had not risen nearly as dramatically. Here indeed was fortification for the arguments of the feather-bed school, and fortuitiously provided at a most dangerous time.

Yet the truth of farming economics in 1953–54 is that farm expenditure, *i.e.* essential costs, rose by 7.7% and actual revenue rose by 6.9%. The explanation of the big rise in farm income (22½%) is that valuation increases followed an excellent 1953 harvest. That this is somewhat transient prosperity is quickly shown by the fact that since then, although after the period covered by the report, the 1954 harvest was a bad one. Again the ordinary citizen is misled—here by the long delay between events and publication. For the stock farms the big 1953–54 rise in valuation for increased animal population represented a liability in 1954–55, when the poor harvest of 1954 led to an enormous jump in expenditure on imported feeding-stuffs.

We do not suggest that farm economics publications should be reduced in number. On the contrary, we believe there should be more of them. But their presentation, especially their terminology, should be free from risks of popular misinterpretation. The prospects of farming are much too closely tied to politics and public opinion.

Nitrogen and legumes

LEGUMINOUS crops ' make ' their own nitrogen—therefore supplying nitrogen as fertiliser is unnecessary and sometimes harmful. This is an argument that has plenty of strong support in farming experience, and even those who believe that some additional nitrogen can be helpful, *e.g.* for peas or beans, limit recommendations to very moderate rates. The dilemma is posed with maximum controversy when the leguminous crop is part of a mixed crop, notably in grass–clover pastureland. Nitrogen is needed for grass output, yet nitrogen will set back the clovers. For this type of pasture, which is found so frequently in Britain, practical farming policies and scientific recommendations vary considerably. Some say that nitrogen is best not used at all, others hold that 1 to 2 cwt. of a nitrogenous fertiliser per annum will do no harm, and a few are bold enough to say that twice or three times as much, if applied in instalments, will depress clovers only temporarily.

An important contribution to thought and theory can be found in a recent British paper from Cambridge (*Journal of Agricultural Science*, 1955, **46**, 441). The experiments reported show that lucerne in a grass–lucerne ley was not set back even though 3 cwt. of sulphate of ammonia were applied each year for three successive years. The nitrogen increased grass output without penalty to lucerne yields. This powerfully

suggests that one of the main causes for clover inhibition by nitrogen dressings is the adverse effect of shading by faster growing grasses—for lucerne, leguminous but taller by nature than clovers, is not similarly inhibited. It also suggests that where the fertiliser-fed grass is frequently cut or kept short by managed grazing, we should expect a much better state of co-existence between nitrogen-fed grasses and nitrogen-sufficient clovers.

A miracle machine

AN amazing new farm machine is in production in Texas, which is said to reduce by 90% the time required by the most modern farm equipment hitherto available. Called the Wonsover, it is 24 ft. long and combines equipment to plough, harrow, condition, seed and fertilise the soil in one operation. Its inventor is Mr. Herman Cohen, Chairman of the Norton Portland Corporation of Portland, Maine.

The pilot model, in use on Mr. Cohen's 300-acre farm in Maine, planted an acre of potatoes in a single operation, taking only 20 minutes. To do the ploughing, harrowing, soil-conditioning, seeding and fertilising with ordinary equipment would have taken about three days, he said.

The machine has a diesel engine to operate the various implements. The present model is not self-propelled, but is drawn by a tractor. The various implements are put into operation through a portable panel of electrical switches, which are attached to the towing vehicle and controlled by the driver. A cable connects the panel to the Wonsover itself. By plugging multiple control cards into the panel a single heavy tractor could pull two or three Wonsovers to speed the preparation and planting of unusually large areas, each machine covering a strip eight feet wide.

At the front of the Wonsover are two bins, one for lime or fertiliser, or both, the other for chemicals to kill weeds or insects. The flicking of a switch will make the machine spread these uniformly over the ground. Behind is a chamber containing a series of as many as 126 blades, depending on the particular job to be done. These blades are arranged to rotate both ways, digging, tossing and mixing the soil and the chemicals previously spread to a depth of 10 in. The soil is broken up in the process as the blades whip it to an almost fluffy consistency with as many as 104,400 strokes a minute. Another revolving blade levels the soil, then a sub-soiler digs down as much as 25 in. to improve the distribution of moisture.

Behind the sub-soiler is a seed bay and apparatus which drops the seed in proper quantities and at the required intervals. Fertiliser is then applied, if desired, from another bin. Eight wheels at the end of the machine pack down the soil over the seed. The tyre treads are so moulded that they leave a notched pattern on the surface to prevent erosion and retain maximum moisture. The final device at the back of the Wonsover will apply a surface spray to kill weeds that might be blown on to the newly planted soil.

The Wonsover can be operated at comparatively high speeds, moving at five to 15 miles an hour. Even the exhaust fumes are made use of, being fed back to the two bins in front, where their sulphur and nitrogen content are mixed with the fertiliser and insecticides.

When on the market the Wonsover machine will cost about $20,000, fully equipped. Mr. Cohen says it would cost about $120,000 for normal equipment to do a comparable job.

New U.S. policy

PRESIDENT EISENHOWER'S 1956 programme in U.S. farm policy is a more forthright effort to deal with the problem of overstocks and surpluses than most observers probably anticipated. But the problem is huge and it is an election year; any failure to make such an effort would have been seized on by the opposition. Somehow the further accumulation of crop surpluses has to be stopped; somehow the existent surpluses must be disposed.

What is called the ' Soil Bank ' Programme may help to deal with the first part of the problem. Farmers are expected to make a voluntary reduction in their crop acreages for wheat, cotton, corn and rice. In return certificates will be issued with a commodity value equivalent to some percentage of the normal yield value of the uncropped acreage. These certificates will be ' financed with commodities already owned and paid for by the Government '. In short, the aim is to use the surplus to reduce future surpluses. Also, land that has been brought into cropping in war and postwar years, but land that is not altogether suitable for arable cultivation, is expected to be shifted over to forage, forestry, and water storage—again voluntarily. It is hoped that some 25 million acres will become a Conservation Reserve, and the Government will pay a ' fair share ' towards the costs of establishing the new uses of affected farmland.

As for disposing of existing surpluses, an Agricultural Surplus Disposal Administrator is to be appointed. Present law insists that these stocks must not be sold at less than 105% of the official paid support price plus storing costs. A change to 100% is recommended by the President. The law also permits disposals abroad to friendly nations only; here also a legislative change is recommended. Clearly, offers of food to countries behind the Iron Curtain are foreshadowed, and there could be some highly interesting economic consequences. If Communist economics run true to form, market prices cannot be depressed to the dis-

advantage of individuals by arrivals of low-cost food. But in any overall sense, disposals abroad cannot bring about a rapid cure for this U.S. problem. Disposals on a scale able to do this would 'shatter world prices and trade'. In the past three years disposals to a value of $4 thousand million have been made—much of them given away. But the U.S. stocks have increased.

The new decisions to reduce future annual surpluses are obviously sound, even though they virtually involve paying farmers to produce nothing on proportions of their cropland. Present *costs* for Government storage of surpluses is running at 'about $1,000,000 a day'! The 'Soil Bank' idea is practicable and likely to succeed, albeit gradually. The stock disposal plans, however, seem much more vague—they may amount to nothing appreciably more substantial than former policy. America may find it far simpler to pay farmers to be less productive than to give away her existent surpluses or sell them below cost.

Farming—and steel centenary

A METALLURGICAL centenary of the year—the birth of the Bessemer steel process, 1856—has considerable association with farming, For it eventually led to basic slag, now for so many years one of the most consistently prized farm fertilisers. Much of the steel made in the early years of the Bessemer furnaces proved to be brittle or liable to crumble. This was traced to the presence of phosphorus. The Thomas-Gilchrist modification of the process put a lining of limestone in the furnace—this material extracted most of the phosphorus from the iron ore, and the separable molten slag was therefore a phosphatic material. But its fertiliser development was somewhat delayed. After cooling, the slag was hard and 'lumpy', often with 'lumps' weighing as much as two tons. Various chemical means were tried for converting this material into a usable fertiliser. Eventually German research showed that a physical method was required—grinding to very fine particle size. Fine particles exposed a much larger surface area to the soil and its solvent actions so that the complex thermal phosphatic substances in slag could release nutrition for crops at a gradual and steady rate. Basic slag, once in production, rapidly established itself as an important fertiliser, especially in Germany and Britain. And, ever since, there has been no reversal in its popularity.

Unfortunately the supply of basic slag has not been expansive during the past 15 years of generally increased fertiliser consumption. The amount of a by-product that is available is determined by supply rather than demand; the economics of steel and slag do not make it possible for slag to be produced for its own sake. Also, there is a modern trend for steel makers to select iron ores with low phosphorus contents, which results in a slag of small phosphatic value, often not worth the substantial cost of grinding to a powder.

There is little doubt that slag is more than a phosphate supplier. It contains useful amounts of trace elements—manganese, for example, is often present to as much as 5%; copper and zinc are found in most samples. Slag also has a useful liming value. It has given unique results in Britain on grassland, especially on poor acid soils in wetter areas. The old saying that clovers follow slag is full of truth.

Hungarian irrigation

AN ambitious project for irrigating the Hortobagy Puszta, a large area of the Great Hungarian Plain, is reported to be well under way. A dam has been built on the River Tisza at Tiszalok and 50% of the irrigation scheme is now operative. The project, part of the first five-year plan which ended in 1955, is the largest and most important irrigation scheme to be developed in Hungary. In addition to irrigating some 260,000 acres of arid land to the east of the river, the dam will generate electric power and, by raising the level of the Tisza, extend navigation of the river and its canal system by about 70 miles to vessels of up to 800 tons.

The Tiszalok irrigation network, which is about 460 miles long, supplies water to areas where there has been no irrigation before, primarily to serve the advancement of livestock breeding, which has suffered considerably in the past 10 years owing to repeated lack of fodder. Rice growing and market gardening are also expected to benefit. On the Hortobagy Puszta last year some 17,000 acres were sown with rice compared with only 125 acres in 1951.

Construction of the dam was begun at the end of 1949 and completed in May, 1954. A small power station is due to be completed early next year.

Irrigation of the Puszta is not a new idea. Schemes for irrigating this and other parts of the country were suggested before the war. In 1937 the Government set up a large fund to promote it, but, owing to the outbreak of war, little came of the project.

In the past the Puszta has been of little use, other than for grazing animals, because of its poor alkaline soil, low rainfall and frequent droughts. In the autumn and spring it turns into sticky mud and in the summer it bakes solid.

The dam has been built across a channel dug out to form a new bed for the waters of the river across a bend in the river, from which the water has now been permanently diverted. The East Main canal, which branches off the left bank of the river, will be over 60 miles long when completed. It conducts water partly directly and partly by way of the West Main canal, which is also under construction, to the irrigation area, thence through a system of draining ditches to the bed of the Hortobagy river.

Soya-bean Adaptation in Sweden

SVEN A. HOLMBERG

The author has for the last 20 years devoted much of his time to the breeding of soya beans and has for that purpose received a special annual grant from the Swedish Government. He has travelled widely for this reason and has visited the U.S.A., Japan and Manchuria; he plans further visits to northern Japan and Sachalin. It appears that many valuable varieties will be gained from the material collected by him.

IN several countries in Europe more or less serious efforts have been made to introduce the soya bean as a crop. What is the reason for these efforts? A short answer may be found in a report to the German Food Ministry delivered in 1949 by Cartter & Strayer:[1] ' . . . soybean protein is regarded by nutritionists as one of the most complete of vegetable proteins, comparable to the proteins of milk, meat and eggs . . . '.

A similar answer is given by Rudorf: ' . . . There is no doubt that soybean protein takes a special place among all vegetable proteins for its content of vitally important amino acids '.[2]

A crop possessing nutritive qualities otherwise confined to animal food products, like milk, meat and eggs, will be an asset at every standard of living.

No doubt the successful introduction of the soya bean into American agriculture added stimulus to European interest in soya-bean-growing experiments. But the cool, more or less marine climate of northern and western Europe raised problems of adaptation not encountered in continental America.

Source of breeding material

In preparing for the introduction of a new crop the first problem is to find a suitable breeding material. ' In selecting species or varieties of crops for any region, careful attention must be given ', state Wilsie & Shaw,[3] ' to the climatic conditions of the areas in which those crops originated '. Since ancient times the soya bean has been grown in eastern, south-eastern and southern Asia. The geographic distribution of the soya bean over Asia, ranging from the tropical belt to lat. 52° north, indicates a wide tolerance to different external conditions. This tolerance of the species is due to the existence of a large number of biotypes, each with a narrow latitudinal adaptation. The northern extremes where soya beans are grown as a major crop in Asia are the plains of the Amur, the Nonni and the Sungari Rivers on the mainland and the Japanese island of Hokkaido. Manchuria has the largest soya-bean-growing districts of Asia.

The German war and prewar efforts to introduce the soya-bean crop were concentrated in the Danube region. For this purpose Manchurian soya-bean strains provided a logical foundation material. Although Manchuria has a warmer (and moister) summer climate than the Danube area, the temperature differences, according to Boerman,[4] are of moderate dimensions (see Table 1).

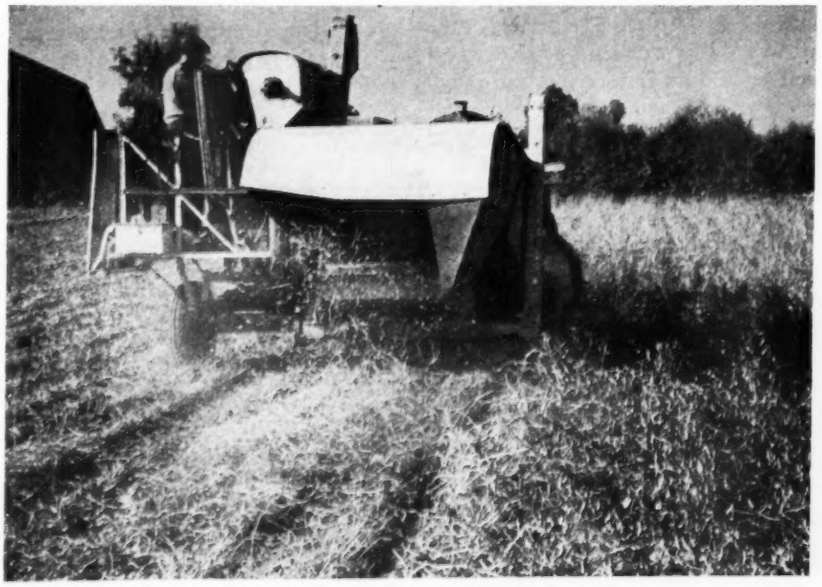
The dominant position of Manchuria as ' the land of beans ' may have contributed to the general use of Manchurian soya beans in introduction experiments also in the cooler regions of Europe.

From a Scandinavian viewpoint, Japan, and especially its large northern soya-bean-growing island, Hokkaido, offers more interest than Manchuria as a possible source of soya-bean-breeding material. The response of soya-bean varieties to temperature and day-length in Hokkaido and their geographical distribution in the island have been studied by Ozaki.[5] Hokkaido is the only country in the world where soya beans are grown as a major crop in a relatively cool and partly marine climate (see Table 2).

In Sweden, July (in Hokkaido,

TABLE 1
MEAN TEMPERATURES FOR JULY

Manchuria	°C.	*Danube region*	°C.
Harbin	22.3	Budapest	21.3
Changchun	23.7	Belgrade	21.6
Mukden	24.4	Bucharest	22.9



Combine harvesting soya beans at Fiskeby, Sweden

TABLE 2
MEAN TEMPERATURES, °C.*

Hokkaido	*May/ Sept.*	*July*	*August*	*Sweden*	*May/ Sept.*	*July*	*August*
Nemuro	12.6	14.2	17.1	Uppsala ..	13.0	16.8	14.8
Wakkanai ..	15.6	17.8	20.5	Visby	13.1	16.1	15.6
Obihiro	15.0	18.2	17.7	Kalmar ..	13.3	16.6	15.6
Sapporo	16.5	19.4	21.1	Karlshamn ..	13.6	16.7	15.4
Asahigawa ..	16.3	19.9	20.7	Ystad	13.5	16.1	15.4

* Temperature records from Hokkaido[6] and Sweden[7] according to Nuttonson.

August) is the warmest month of the year. The gap between monthly mean temperatures in Hokkaido and Sweden, therefore, widens towards the end of summer.

Compared to the marked temperature contrast between Manchuria and northern Europe, the differences between Hokkaido and Sweden, although considerable, do not appear to be a deterrent factor. There is no doubt that soya-bean-breeding material from Hokkaido holds more promise for Sweden and generally for northern Europe than material from Manchuria and other regions with a typically continental climate.

In accordance with this surmise, the author brought home to Sweden in 1940 a collection of soya-bean strains from Hokkaido and southern Sachalin (Karafuto).

Temperature and light

Records of mean temperatures as referred to above may be useful for general guidance in selecting sources for breeding material. But extremes rather than means of temperature often draw limits to crop distribution. It is also a well-known fact, both to science and practical farming, that the tolerance to temperature varies according to the stage of crop development. Although the soya bean responds favourably to moderate heat at any phase of development, it withstands cool conditions at germination, emergence and early growth better than at flowering and seed ripening.

At both ends of the growing season extremes of low temperature are most likely to occur. For adaptation to a marine climate, with its slow and gradual warming up of the soil in spring, it would be valuable to find biotypes with low-temperature requirement for germination. The experiments of Japanese scientists indicate the existence of varietal differences in this respect.[8]

At a northern latitude frost resistance at emergence and later is also a matter of consequence. Inouye, Yamasaki & Matsuura have found differences among Japanese varieties in resistance to leaf injury by frost.[9]

Any growing experiment with soya beans under artificial light will demonstrate the relatively high requirements of the soya-bean plant for light energy. In Sweden at lat. 56–60° the light intensity is considerably lower than at the ecological optimum along lat. 40°.

A table computed by the Finnish physicist, Kalaja, demonstrates the solar radiation that can theoretically reach the ground surface at different dates on different latitudes. The changing influences of the atmosphere and of the absolute solar radiation cannot be considered. The radiation on 21 March at the Equator is indicated by 100. The belt between lat. 40° and 50° has a favourable soya-bean climate. Latitude 60° (Uppsala, Helsingfors) is referred to for comparison[10] (see Table 3).

TABLE 3
EXTRACT OF TABLE OF SOLAR RADIATION AT DIFFERENT LATITUDES COMPUTED BY KALAJA

	Lat. 60°	*Lat. 50°*	*Lat. 40°*
20 April	75	85	94
5 May	87	96	101
20 ,,	98	103	107
5 June	104	107	109
21 ,,	106	109	110
6 July	103	107	109
22 ,,	97	102	106
6 Aug.	87	95	100
22 ,,	74	84	93
7 Sept.	59	75	83
23 ,,	45	60	73

TABLE 4
DURATION OF AVERAGE FROSTLESS SEASON (NUTTONSON[6,7])

Japanese stations[6] (45 years' record)	*Days*	*Swedish stations[7] (30 years' record)*	*Days*
Nemuro	135	Uppsala	122
Obihiro	121	Kalmar	169
Sapporo	129	Karlshamn	156
Asahigawa	168	Lund	184
Hakodate	152	Visby	183

According to Table 3, the potential solar radiation at lat. 60° during the three-month period 5 May–6 August (from planting to end of flowering) is 30% less than at lat. 40° and 9% less than at lat. 50°.

During this period the lower light intensity at lat. 60° is largely compensated for by a longer day period. In the latter part of August the declining day-length is increasingly incapable of compensating the widening difference in light intensity.

Excepting regions and years of extreme cloudiness, the soya bean (of day-neutral type) would normally find sufficient solar energy for emergence, early growth and flowering at lat. 60°. Obviously the autumn, from the middle of August, is the critical period at lat. 60°.

Even under normal weather conditions the ripening will be a slow process. In a cold year there is a risk of frost before full maturity is reached.

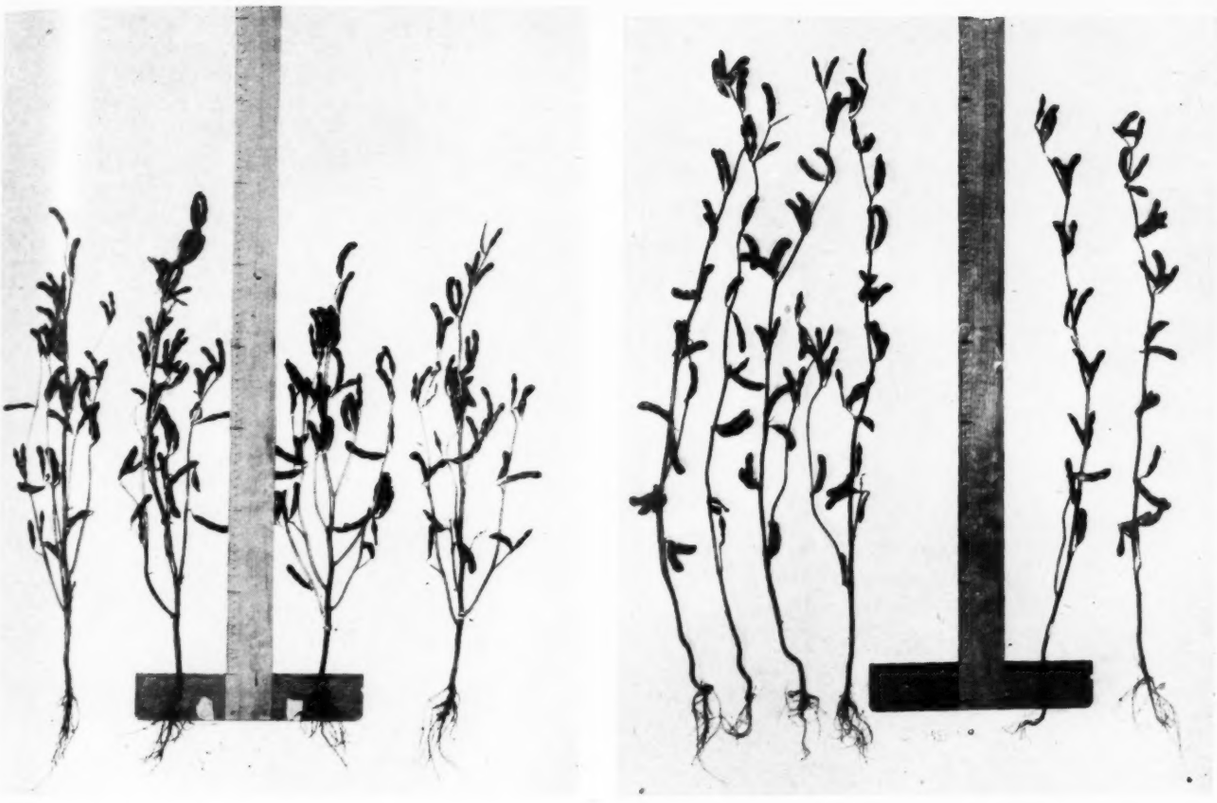
Although the Kalmar-Oland region (lat. 56–57°), where the Fiskeby varieties of soya beans are commercially grown, enjoys a longer frost-free season than many soya-bean-growing districts of Hokkaido, northern Manchuria and northern U.S.A., this relatively long growing season is required to ripen extra early varieties in a cool autumn (see Table 4).

The period from planting to harvest varies according to the weather (Table 5).

Only the breeding of Swedish soya-bean varieties combining earliness with adaptation to the day-length of the latitude has made it possible to grow soya beans regularly in Sweden.

A further reduction might be attained in the time schedule of one phase or other of soya-bean development. The great differences in total life period between soya-bean varieties are well known. According to the experiments of Nagata (1948–50) with 136 soya-bean varieties, there are also differences in the relative length of the periods (*a*) from germination to beginning of flowering and (*b*) from beginning to end of flowering.[11]

In 1953 a series of crosses were made between Fiskeby strains and one Japanese strain with the aim of combining the early beginning of flowering of the former with the short duration of flowering of the latter.



These pictures represent two strains of soya beans, the leaves are shed and the location of the ripened pods is visible. Both strains are medium tall (50 cm. and 75 cm.). Both have a determinate growth habit, but one (840-2-1) (left) is branching, and the other (856-3-15) (right) is non-branching, more like a field pea than a bean

Day-length

The soya bean as a species is a typical short-day plant. The length of day (night) during early summer influences the date of beginning of flowering (Table 6).

The difference in day-length between lat. 40° and lat. 60° attains a maximum of about four hours around the summer solstice. The difference between lat. 45° (northern Hokkaido) and lat. 56° (southern Sweden) at the same time is two hours. In addition to the longer day at the northern latitudes, there is also a longer twilight.

The day-length of early summer at lat. 56–60° inhibits flowering of most foreign soya-bean varieties and excludes their cultivation in Sweden.

But different soya-bean varieties have different responses to day-length. There are also numerous biotypes of soya bean that are day-neutral. Natural selection at Fiskeby, Norrköping, at lat. 58° 30′ has allowed only day-neutral biotypes to survive.

The dates of beginning of flowering recorded at Fiskeby for nine years testify to the day-neutral character of Fiskeby soya-bean material (see Table 7).

As to be expected, the temperatures of early summer, and particularly of June, seem mainly responsible for annual variations in dates of soya-bean flowering.

The day-neutral character of Fiskeby soya-bean strains has further been studied and confirmed by Rudorf.[12] It will not be photoperiodism, but probably the temperature factor, that will draw the final northern limit of the soya bean in Sweden.

Moisture

A character of the summer monsoon climate, which prevails in the soya-

TABLE 5
THE LIFE PERIODS (FROM EMERGENCE TO MATURITY), IN NUMBER OF DAYS, RECORDED FOR FISKEBY III–18 AT FISKEBY (NORRKÖPING)

	Year									
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954
Fiskeby III–18 ..	136	139	114	128	132	122	125	142	124	143
Fiskeby III–20 ..	136	124	112	123	127	118	125	—	117	143

TABLE 6
DAY-LENGTH DURING EARLY SUMMER, HOURS

Lat.	*Region of*	20 *May*	30 *May*	9 *June*	19 *June*	29 *June*	9 *July*
60°	Uppsala, Sweden; Helsinki, Finland ..	17.28	18.09	18.37	18.52	18.48	18.26
58°	Gamleby, Sweden ..	16.59	17.34	17.59	18.10	18.07	17.49
56°	Kristianstad, Sweden ..	16.34	17.05	17.27	17.38	17.34	17.18
50°	Aigun, Manchuria Winnipeg, Manitoba	15.36	15.59	16.14	16.22	16.20	16.09
45°	Peiping, China; Wakkanai, Hokkaido; St. Paul, Minn. ..	15.00	15.18	15.31	15.37	15.35	15.26
40°	Antung, Manchuria; Urbana, Ill. ..	14.31	14.46	14.56	15.01	15.00	14.52

TABLE 7
BEGINNING OF SOYA-BEAN FLOWERING AND JUNE MEAN TEMPERATURE AT FISKEBY

	Year								
	1946	1947	1948	1949	1950	1951	1952	1953	1954
	9 *July*	30 *June*	9 *July*	7 *July*	6 *July*	16 *July*	11 *July*	27 *June*	14 *July*
Mean temp., °C., June..	13.8	16.8	14.9	13.9	15.9	14.2	13.5	16.9	14.9

TABLE 8
RELATIVE HUMIDITY DURING SUMMER MONTHS (NUTTONSON[6,7])

Japanese stations[6]	*June*	*July*	*August*	*Swedish stations*[7]	*June*	*July*	*August*
Nemuro ..	90	92	92	Uppsala ..	69	73	80
Obihiro ..	80	84	85	Kalmar ..	77	79	81
Sapporo ..	81	84	83	Karlshamn ..	72	75	80
Asahigawa ..	75	80	82	Lund	70	75	78
Hakodate ..	82	85	83	Visby	70	76	78

bean-growing countries, Japan, Korea and Manchuria, is the high relative humidity of the air compared to Sweden (see Table 8).

Preference

Twenty years of practical field growing of soya beans in Sweden seem to indicate a preference for the driest corner of the country, the Kalmar-Oland region. A high relative air humidity may be favourable to the soya bean when combined with the light intensity of the ecological optimum. It may not be favourable under the lower light intensity of northern Europe.

Normally the rainfall in the Kalmar-Oland growing district is sufficient for the soya-bean crop. Long periods of drought that occur not infrequently in the region may reduce the yields, but not more for soya beans than for other crops grown in the district.

Adaptation by selection

In 1941 soya-bean seed of three early foreign varieties was distributed by the Swedish Government Food Commission (Statens Livsmedelskommission) for practical growing trials to farmers in the provinces Oland and Gotland. The Government Food Commission reported on these trials on 19 November, 1943: ' . . . for some reason most of the cultures failed. In any case the crop was so poor that continued growing could not be considered economical . . . '.

Although the experiment of growing foreign soya-bean varieties was soon abandoned, the breeding of soya beans with a view to adaptation was pursued with the support of the Government both at Svalöf (Swedish Seed Association) and at Fiskeby (Algot Holmberg Seeds Ltd.). In 1950 a brown-seeded soya bean, Sv. Ugra, stemming from a cross Wisconsin Black crossed with a Polish variety, Brunatna Vilenska, was announced for introduction by Svalöf.[13] The yellow-seeded Fiskeby III, originating from a cross between a German strain (' type XX st. 9 ') and a Sachalin variety (Nami Kawa) was released by Algot Holmberg Ltd. in 1949.[14] Fiskeby III, being an edible type, was tested and approved for use in Army rations, school lunches etc. It is grown commercially on a small scale in the Kalmar-Oland region. An account of yield-test results obtained with this variety at Fiskeby (Norrköping) is available for a period of 10 years (see Table 9).

Typical soya-bean plants, Fiskeby III, from the 1954 crop

Yield variations

Besides differences in soil, differences in temperature are probably the principal cause of annual yield variations. But records of temperatures registered in the shade are only an imperfect index for comparing field-growing conditions for different years. This is particularly noticeable in large annual variations for cloud and sunshine.

In one year (1952) of 10 the crop of Fiskeby III failed. The failure of 1952, although shared by other late-ripening crops established in the region, proves that further adaptation of the soya bean is required. The cold summer of 1952 also provided an opportunity for selection of lines and individuals better adapted to the extremes of a Scandinavian climate.

The following summer was too warm for further progress in adaptation. But the summer of 1954, being exceptionally cloudy from midsummer to the end of the growing season, was selective for adaptation to low light intensity.

An example is given in Table 10 of two Fiskeby soya-bean strains with different degrees of response to the conditions of 1954, which were remarkable for cloudiness and lack of sunshine, particularly in the period June–August (see Table 10).

The conditions of 1954 were favourable to selection towards better adaptation. Among the 641 strains at Fiskeby, 60 strains and 880 individuals were selected.

Swedish soya beans are relatively low in oil content, usually containing about 16%. In protein content they are not inferior to imported soya beans.

TABLE 9
SOYA-BEAN VARIETY FISKEBY III-18. TEST RESULTS 1945–54

	Year									
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954
Yield, kg./ha.	1,650	2,095	1,680	1,572	1,881	1,373	1,440	500	2,266	1,290
Mean temp., ° C., May–Sept.	14.4	13.9	16.0	14.0	14.7	14.3	13.5	12.6	14.5	13.9

Mean yield, 10-year period 1945–54 = 1,575 kg./ha.

Swedish soya beans are grown for their protein value and used for food. The quality of Fiskeby III as an edible bean is a Japanese heritage. Its use is not confined to periods of food shortage or meat rationing. The price of Swedish soya beans enjoys no Government support.

The relatively rapid success in selecting day-neutral types is explained by the absence of annual changes in day-length. Otherwise the climate of Sweden, alternately dominated by marine and continental influence, is rich in annual variations. Under these changing external conditions the thorough adaptation of a crop is a long and gradual process. The extremes of cold and cloudiness of the years 1952 and 1954 were valuable for the purpose of selection.

Japanese material

Soya-bean material from Hokkaido and Sachalin has been utilised for breeding in Sweden only since 1940. This Japanese material was used at Fiskeby in some 2,700 hybridisations, followed by selection for adaptation. The choice of Hokkaido and Sachalin breeding material has reduced the adaptation problem for Sweden to practicable dimensions.

In Holland a private breeder, Dr. Louis Koch, also used northern Japanese material with good results. The successful breeding work of Dr. Koch has not been continued in Holland, but his strains have been maintained.

There is reason to expect that further breeding work on the basis of Hokkaido and Sachalin material will lead to closer adaptation of the soya bean to the temperature and light climate of Sweden and other countries of northern Europe.

Fiskeby 748-6 (*from a cross Pagoda* × *Fiskeby No.* 201-8-29), *harvested September* 1955

REFERENCES

1. Cartter, J. L., & Strayer, G. M., 'Soybean crop production and utilization', ECA Technical assistance project 07-03
2. Rudorf, W., 'Beobachtungen auf dem Gebiete der Pflanzenzüchtung in U.S.A.', Hamburg 1950
3. Wilsie, C. P., & Shaw, R. H., 'Crop adaptation and climate', *Advanc. Agron.* 1954, Vol. IV
4. Boerman, W. E., Klimaat, Rotterdam, 1949
5. Ozaki, K., 'Temperature and day-length during the growth period of soybeans. Response of varieties and their relation to the geographical distribution of soybean in Hokkaaido.
6. Nuttönson, M. Y., 'Agricultural Climatalogy of Japan', 1949. (Washington D.C.: American Institute of Crop Ecology)
7. Nuttönson, M. Y., 'Agricultural Climatalogy of Sweden', 1950. (Washington D.C.: American Institute of Crop Ecology)
8. Furutani, Y., & Kukii, M., 'On the germination of soybeans', Kyushu Agric. Res., 7, 1950
9. Inouye, C., Yamasaki T., & Matsuura, M., 'On the resistance of crop plants to low temperature', Reports of the Kochi University, Natural Science, No. 2., 1952
10. Kalaja, P., 'Die Verthältnisse der Menge der von der Sonne auf die Erdoberfläche gelangenden Strahlung auf verschiedenen Breiten und in verschiedenen Jahreszeiten.' Eripainos Terraste No. 2, Helsinki 1948
11. Nagata, T., 'Studies on the growth habit of summer vers autumn soybeans'. *Proc. Crop Sci. Soc. Japan*, (*a*) 1948, (*b*) 1950
12. Rudorf, W., Max-Planck-Institut-für Züchtungsforschung (Erwin-Baur-Institut) Voldagsen 1953.
13. Andersson, G., Svalöfs Ugra soja. Sver. Utsädesför.Tidskr., 1950
14. Holmberg, S. A., 'Sojabönodlingens möjligheter', *J. R. Swed. Acad. Agric.*, 1950

Addendum

Mr. Holmberg has provided further information since the original article went to press.

In 1953 the seed supply only admitted small propagation plots.

In 1954 nine growers harvested 7,500 kg. of edible soya beans (with 14% moisture) from an area of 7.1 ha. The mean yield in field culture was, therefore, 1,056 kg./ha.

In 1955 the area planted was 15 ha.

The soya beans are mostly grown on sandy or gravelly soils. The first growers used to pull the crop by hand. In recent years the soya beans are nearly always cut by mower and dried on racks in the field.

In a dry autumn we have combined early-ripening varieties. The introduction of very early strains, now in propagation plots, will probably lead to more frequent use of the combine in our small plots.

The commercial field cultures, however small, are valuable to the breeder because they confront him both with the practical problems of soya-bean farming (weed control, method of harvesting) and the desires of the canner and consumer.

The existence of a small production of Swedish soya beans in an open market, free of import duties, is based on their edible quality and their use as food.

TABLE 10

Strain No.	*Plants per sq. m.*	1954 (1953)		*Relation of seed yield 1954 to 1953 (kg. ha.; 1953 = 100)*
		Seed yield		
		g./plant	*kg. ha. (kg./ha.)*	
840-2-7	41	2.72	1,108 (1,340)	83
846-2-1	45	0.52	233 (1,675)	14

To Authors and Readers

The publishers of WORLD CROPS invite the submission of manuscripts of books to be considered for publication. All manuscripts will be promptly acknowledged and carefully considered by qualified experts. A synopsis with chapter headings should be sent in the first instance, addressed to the Book Production Manager.

The publishers are specialists in industrial, technical and scientific books and have a world-wide selling and distributing organisation.

A FARM SERVICE IN VENEZUELA

(Servicio Shell para el Agricultor, Venezuela)

Although Venezuelan agriculture receives government aid in the form of irrigation schemes, agricultural machinery supplies, rural roads and other similar services, it was considered that this in itself was not sufficient to obtain optimum production from Venezuelan agricultural areas. Education was considered a primary necessity. Therefore, an advisory service was set up by a premier petroleum group in 1952. It is known as Servicio Shell para el Agricultor. The service provided is free of charge and its work is carried out in close co-operation with Government and other agricultural advisory establishments.

Introduction:

Venezuela, like the rest of Latin America, relies for its food to a large extent on imports from the U.S.A. and Canada. It is the policy of the Venezuelan Government to encourage home production of food by every possible means. Proceeds from the petroleum industry are being used to subsidise production, and protective tariffs are levied and import quotas laid down in order that the Venezuelan farmer may profitably increase his output. By ploughing back into agriculture these large resources, the country will achieve a more balanced economy.

At present, however, Venezuela's five million cultivated acres provide only about half of her food requirements and with increasing population and the constantly rising standard of living of the people, even this proportion will not be maintained without a corresponding increase of production from the land. The large potentially fertile areas have suffered in the past from unfortunate farming practices. Tree cover has often been rashly removed and over-grazing by goats is common. The climate however, especially in the highlands, is favourable and with knowledge of modern farming methods there is no reason why the Venezuelan farmer should not be able to contribute much more to his country's larder.

Government aid to agriculture, in the form of large irrigation schemes, supply of agricultural machinery, building of roads in rural areas and other services of a like nature, is not by itself sufficient to develop the country's production to its optimum. Education of the farmer in new techniques is a most vital factor in achieving this aim. The farming unit in Venezuela is predominantly a small one. Taking as an example the chief crop, coffee, the average size of a plantation is only 13 acres. The task of getting at the individual farmer and demonstrating to him the advantages of good husbandry is therefore a formidable one. Supplementing the work of the Government in this direction is a service provided by one of the petroleum interests in Venezuela, of which the following is a brief account.

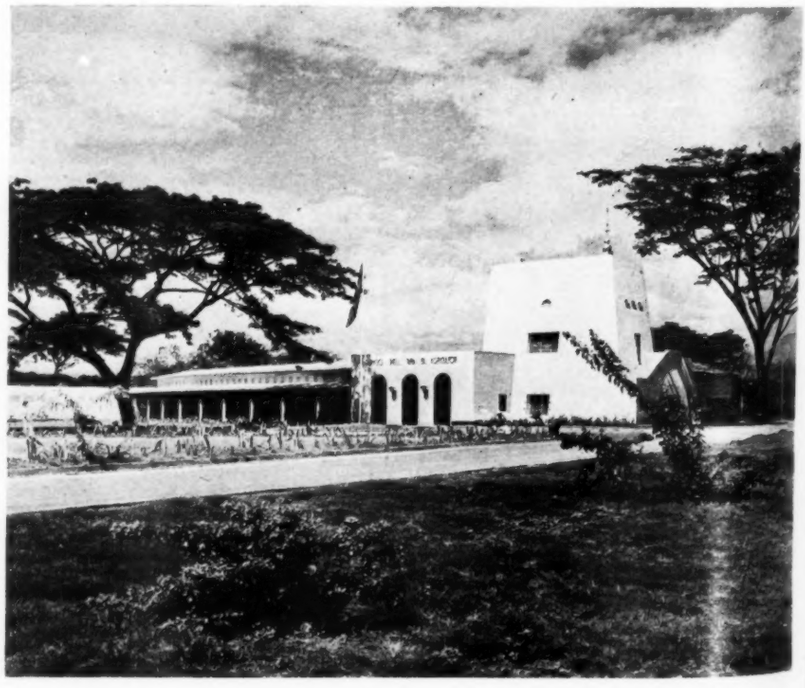
The Service and its location

The Shell Agricultural Service is a non-commercial entity established with the sole object of contributing to the development of Venezuelan agriculture by the study and propagation of suitable methods applicable to agriculture. Its services are provided free of charge and its work is carried out in close contact and collaboration with Government and other agricultural advisory establishments.

The Service was established at the beginning of 1952 and operated for some time from provisional offices in the village of Cagua, district of Sucre in the State of Aragua, and on land which was purchased to carry out experimental work in the immediate vicinity. It is on this land that permanent offices, laboratories and workshops have been built.

The land on which the experimental work is undertaken covers an area of approximately 100 acres. Various factors were taken into consideration when this site was chosen and the following were among the most important:

(*a*) The valleys of Aragua are probably one of the most developed agricultural regions in the country and close to Cagua there are



The Shell Agricultural Service building, Cagua, Edo. Aragua

about 60,000 acres under irrigation.

(*b*) The National Institute of Agriculture and Livestock and the Central University's Faculty of Agriculture are stationed in the neighbouring town of Maracay. A wide measure of co-operation has been established with these bodies.

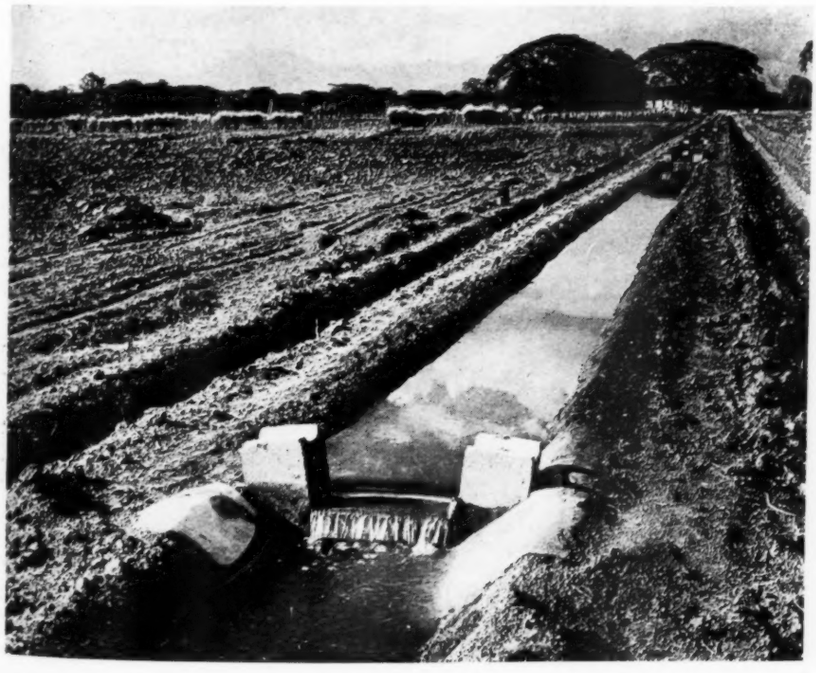
Application of pre-emergence weedkiller on a farm in the State of Aragua. The supervision of this type of work is included in the extension activities of Servicio Shell para el Agricultor

Organisation

The Service is under the supervision of a director and vice-director and the work is divided into six sections, namely Agronomy, Entomology, Phytopathology, Chemistry and Soils, Agricultural Engineering and Information. Each of these sections is headed by a specialist, assisted by a group of agronomists and additional personnel where necessary. The sections have at their disposal, besides the farm land belonging to the Service, well-equipped specialist laboratories, a workshop for agricultural engineering and extensive transport facilities.

Function

The Service is in direct personal contact with the man on the land, and the activities of the Service are directed towards extension work. Trained personnel travel from farm to farm throughout the main agricultural producing areas discussing problems and, where possible, providing the farmer with practical and immediate solutions. Frequently, however, these problems have to be solved in the Service's laboratories or on the experimental farm, or, as is often the case, on the farmer's own land. It is worthy of note that all crops produced during the course of experimental work are donated to charitable and other institutions.



An experimental canal in use on the property of Servicio Shell para el Agricultor

Information of interest to the farmer in the form of bulletins, as well as a monthly newsletter, is distributed throughout the country. Farm field days are held at frequent intervals during which demonstrations are made of the use of proven types of agricultural machinery and equipment. Already it has been possible to show that crops hitherto grown only in the dry season can be grown during the rains. This applies particularly to potatoes and certain other vegetables susceptible to heavy attack by fungus diseases and severe competition from weeds during the period of wet weather.

During 1954 the personnel associated with the Service carried out 721 visits to 270 farms and the distance covered by transport units over the same period totalled some 500,000 km. The number of farm visits for 1955 is estimated at 2,000.

Summary of section activities

(*a*) *Agronomy*

The Agronomy Section specialises in the improvement of methods of cultivation of crops. This work includes

the study of existing practices employed in Venezuela and of methods that have yielded good results in other comparable countries. A considerable amount of work is under way in connection with the introduction of varieties of vegetables and other crops new to Venezuela. The use of modern chemical weedkillers is also the object of intensive study, more especially as the chemical control of weeds in crops as a replacement for hand-weeding is a possibility of great importance in Venezuela.

(*b*) *Entomology*

Crop losses due to the failure to control insect pests can be disastrous to the agriculturist. The evaluation of all types of insecticides for the control of these pests is carried out by the Entomology Section and recommendations on the use of these products, including dosage rates and time and conditions of application concerning a wide variety of crops, are given to the farmer. Many field trials are carried out and, in certain circumstances, the supervision of the field application of insecticides by the farmer may also be undertaken. In collaboration with the Ministry of Agriculture, an investigation to discover methods of control of the serious mealy-bug/ant complex, which attacks the roots of coffee trees, is now under way.

(*c*) *Phytopathology*

This Section is concerned with the fungus, virus and nematode diseases of plants. From the results of experimental work carried out by this Section, it has been found possible to control successfully fungoid infections of potato plants and thus make possible the production of this crop during the wet or rainy season. Some 200 ha. of potatoes were planted by farmers during the rains this year with good results, and if this is followed through it may well prove unnecessary to import potatoes in the future. It may be mentioned that 45,000 tons of potatoes were imported by Venezuela during 1954.

Other crops such as tomatoes, peppers, onions etc., presently only produced in the dry season because of the difficulty with fungoid infections, are being experimentally grown under wet conditions.

(*d*) *Agricultural Engineering*

By means of field demonstrations, this Section is advising the farmer on the economic and efficient use of agricultural machinery. A number of 'time and motion' studies are being carried out. Emphasis is placed on machinery designed for the seeding and harvesting of crops and also application equipment for insecticides, fungicides and soil fumigants. Problems related to irrigation and drainage are studied and, wherever possible, practical assistance is rendered to the farmer.

(*e*) *Soils*

An intensive study and survey of the soil types of the most important agricultural producing areas is under way. A fully equipped chemical laboratory is at the disposal of the Section where the examination of soils and crops is carried out and deficiencies of major and minor elements are determined. The fertiliser requirements of given crops are investigated and field trials carried out in conjunction with the Agronomy Section. The farmer is advised of the type and quantity of fertiliser he should use to give optimum yields. A preliminary study of certain saline soils of the Cagua valley area is being made, since incipient salinity and the reclamation of saline soils is a subject of substantial importance.

(*f*) *Information*

This Section receives all visitors to the Station and arranges contacts for them with the other Sections. It is responsible for arrangements in connection with farm-demonstration practices, and for exhibits at agricultural fairs. It maintains a photographic record of work carried out by the Service, produces bulletins and information sheets and a monthly newsletter for distribution throughout the country. Arrangements for the exhibition of agricultural films to Universities, schools and the farming community, also for lectures and discussions to interested parties, are important functions of this Section.

The Destructive Daisy

The pyrethrum (*Chrysanthemum cinerarivefolium*) is a glaucous perennial which grows to a height of 18–24 in., and to the casual observer is similar to a field daisy; however, this plant contains the base for one of the most destructive insect sprays and powders yet developed.

Pyrethrum powder is said to have been introduced to Europe by an Armenian merchant in the early nineteenth century. This merchant is reputed to have obtained the powder from Persia, and it was consequently called Persian powder.

By 1905 an appreciable trade had developed in dried pyrethrum from Montenegro, and other parts of Dalmatia, to Italy, for use as an insecticide, but it was not until after the first world war that it was used as a basis for fly-sprays, and later as a method of controlling aphides and the celery fly (*Philophylla heraclei* L. syn. *Acidia heraclei* L.).

During the second world war pyrethrum was used considerably, particularly in the tropics, in the fight against malaria and dysentery. Regular spraying of aircraft has almost completely prevented the spreading of yellow fever from the countries where it is endemic.

Perhaps the greatest advantage that pyrethrum has over chemical sprays is its instability; toxicity is lost in a short time and insects do not have the opportunity to develop immunities, as they are inclined to do with the stable chemical sprays.

American insects such as flies, bugs and cockroaches are being sent to the new £25,000 research plant at Nakuru for 'effectiveness tests' with African Pyrethrum. This is because America takes over half of East Africa's production from this £1 million industry.

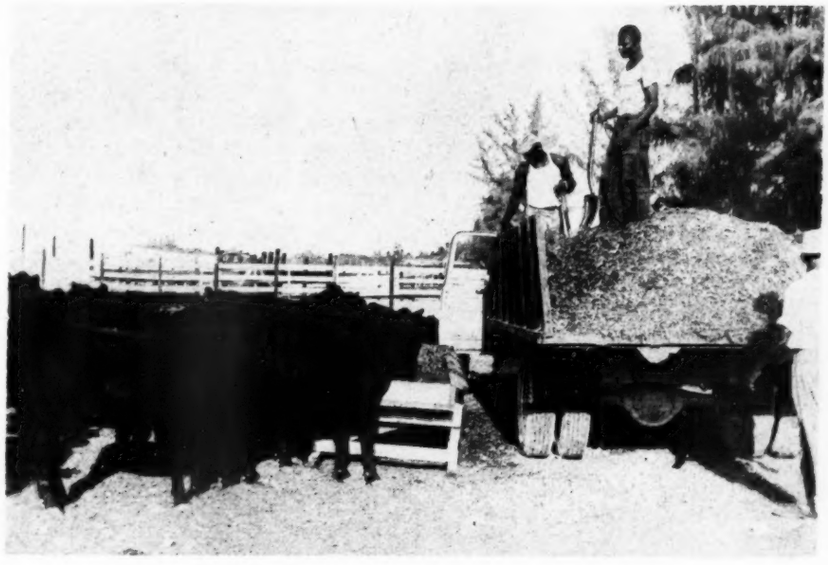
The laboratory at the research plant will be devoted entirely to pyrethrum research, to the development of the spray and powder and to examining the by-products of the flowers; it will be the first in the world to do so. As a result of this research it is expected that African Pyrethrum will be one of the most sort after insecticides produced in the world.

A SUCCESSFUL BAHAMIAN VENTURE

A Note from the Island of Eleuthera

DURING the course of a recent visit to the Bahamas, the Chairman of Leonard Hill Limited, Mr. W. Leonard Hill, was privileged to visit and tour a very successful reclamation scheme, managed by Mr. Juan Fernandez, in the centre of the 100-mile-long island of Eleuthera. Mr. Fernandez is an Argentinian who was educated at the University of Buenos Aires, where he gained a degree in Agricultural Engineering. He later attended Kansas State College and took a Master's degree in Animal Nutrition.

The object of this estate is to produce cattle for the local markets of Eleuthera and Nassau; for this purpose five service bulls are maintained and young registered stock bulls are imported from Florida and Virginia. The young bulls usually run with thirty-five heifers each; Aberdeen Angus is the breed chosen. It appears that they will stand up well to the climatic conditions. These and other beef breeds are usually crossed with Brahmans in Texas and New Mexico. A spring calving is aimed at, owing to the climatic conditions which, although they can almost be termed temperate, necessitate yarding the cattle for three to four months.



Feeding silage to the cattle on Eleuthera. Sorghum is cut for silage, transferred to pits, compressed, and roofed with palmetto

This is due mainly to lack of grass and the necessity for shade; during this time the cattle are fed with silage to which is added 35 to 40 lb. of molasses, a quarter pound of urea (du Pont 262) and 1 lb. of concentrate, giving 42% of protein. Concentrates are used as they make for saving in freight.

The calves are allowed to run with the dams for approximately eight months; they are weaned at 400 lb. and run on grass for a further four months. At the end of this period they are usually brought into the yards, weighed monthly and fed to make 1,000 lb. at twenty-two months. Careful costing is made for weight increase against the weight and cost of food consumed.

From the age of 12 months the calves are brought into the yards and are weighed monthly. They are fed to make 1,000 lb. at 22 months

Silage

Sorghum (called Guinea Corn by the Bahamian natives) is used for the silage; it is cut when it is eight or nine feet high, chopped and blown into four-wheeled trailer bins, drawn by John Deere tractors. The sorghum is then transferred to pits, compressed by a 4D crawler tractor and roofed to a depth of 4 in. with palmetto, which compresses to an impermeable mat. The silo floor has a 1½-in. fall to the discharge end and it was noted that no molasses or other additive is combined with the silage in the pit.

The sorghum is sown in 14-in. rows and as the weeds do not exceed a height of 24 in. they are soon overtaken and strangled by the main crop. The pastures have been planted with Pangola grass, a native of South Africa, developed and acclimatised in Florida. It is first introduced by planting cut-

tings in moist soil, and it spreads by issuing new shoots from runners. When cut at 3 or 4 ft. the cuttings spread and new shoots appear. In many parts of this country limestone outcrops occur but the Pangola crop rapidly spreads and covers the outcrop.

Sufficient water is normally found at eight feet; wells can be sunk to a lower depth, but they generally lead to brackish water. Irrigation pipes in 40-ft. lengths are used and are easily transportable to the standpipes, where quick release connections are standardised.

Slaughterhouse

This development project was expected to pay for itself within five years, but once the slaughterhouse is in full production, the estate is expected to at least cover itself in two years. The slaughterhouse is built of pre-cast concrete blocks 7½ in. × 16 in. × 8 in. The ceiling height is 16 ft. The overhead rail from slaughterhouse to cold store, doors and cooling equipment were designed and supplied by Koch of Kansas City; the room itself is capable of storing 30 carcasses plus small goods. Fibre-glass is used to insulate the cold room. There is a ramp entrance for cattle on the hoof and a loading-height outlet for the carcasses. The final product will be wax-paper wrapped with a cheese cloth shroud and will be sold to the local and Nassau butchers. At present the offal is converted into fertiliser, but, when the output is sufficient, a drier will be installed and by-products prepared and marketed. In the meantime, the blood is fed to pigs, which are not at this stage being bred on a large scale.

There is on the farm, but run rather as a hobby, a small flock of 'local' sheep. These are referred to as 'hair type', the tenuous covering they have justifying this description. They have, however, been tupped with Suffolks and the resulting lambs certainly have less and shorter wool. The lamb fall was over 120%, but losses, mainly from worrying, were not inconsiderable; 70% twins helped to maintain the net yield.

The land for this operation was taken over from the Colonial Development Corporation, who are leaving some of their large holdings; but various operations on former C.D.C. property are going on, chiefly under American enterprise. As Mr. Fernandez remarked 'I inherited a lot of good things from Colonial Development Board', and I cannot help wondering whether the decision made by the C.D.C. to curtail their operations in this area was a wise one.

Empire Cotton Growing Corporation

Dr. Joseph Burtt Hutchinson, who was awarded a Knighthood in the New Year Colonial Office Honours List, is the Director of the Empire Cotton Growing Corporation's Research Station at Namulonge, in Uganda. He joined the staff of the Corporation's Research Station in Trinidad in 1926, and apart from four years' work at the Institute of Plant Industry in Indore, in order to gain experience of cotton growing in India, he has been a member of the Corporation's staff ever since.

He became head of the Genetics Section in Trinidad in 1937, and later Cotton Adviser for the West Indies, and when the Trinidad Station was closed down in 1944, the year in which he was awarded the C.M.G., he toured the cotton-growing areas of Africa before being stationed at Shambat, in the Sudan. In 1949 he succeeded Mr. Parnell as Director at Namulonge, and was elected a Fellow of the Royal Society two years later.

In recent years, in addition to his work on cotton, he has been actively interested in general education in East Africa, being Chairman of the Makerere College and a member of the Governing Body of the Royal Technical College of East Africa.

In his position as Director of the Corporation's Cotton Research Station in Uganda, and with his wide knowledge of the cotton crop in Africa, America, India and the West Indies, Dr. Hutchinson has had a considerable influence on cotton growing in Africa. For example, the report which he wrote at the request of the Nigerian Government, after visiting the territory with the Corporation's senior entomologist in 1947, has undoubtedly contributed to the rapid increase in cotton growing which has taken place in that territory in recent years.

It is a great tribute to Dr. Hutchinson and to the work of the Empire Cotton Growing Corporation that he should have been honoured by the award of a Knighthood.

Value of Safflower Seed

More experimental plots of safflower are being grown on the Darling Downs, Queensland, as part of a programme aimed at determining the commercial value of the crop. They have been arranged by the plant industry division of the Australian Commonwealth Scientific and Industrial Research Organisation in conjunction with the Queensland Department of Agriculture.

As a result of previous Queensland trials, safflower promises to develop into a more important crop than linseed. Yields have been twice as great as those from linseed under similar conditions.

Addressing a recent meeting of the Queensland Grain Growers' Association, a member of the advisory committee on cereals, Mr. J. C. Eggleston, said that the present consumption of safflower oil in Australia was about 3,000 tons a year, with the demand increasing. Most of the oil came from India, and consumers were paying A3s. to A4s. a gallon above the ruling price of linseed oil.

Mr. Eggleston said that safflower had certain advantages over linseed oil. It was easily extracted, required no complicated process in refinement, remained stable in storage and did not sludge. The oil had a high iodine count which made it a good drying oil, and it was particularly suitable for the new plastic paints and in the manufacture of certain synthetic resins for industry.

To meet the present Australian demand for 3,000 gallons, a planting of between 10,000 and 15,000 acres would be needed, and on present prices the crop returned £A5 an acre more than linseed.

An important feature, added Mr. Eggleston, was that safflower was a dual-purpose crop, as it could be grazed and was readily eaten by stock. It appeared to be free from any disease, the only pest so far noted being the green aphis. Safflower was also the most drought-resistant of all oil-producing crops.

THE RUPUNUNI SAVANNAHS

C. H. BROWN, B.SC.

Mr. C. H. Brown is well known to readers as the author of a number of papers in WORLD CROPS. This note describes the possibilities that exist for the improvement of agricultural conditions in a little-known district of British Guiana

THE remorseless increase of world population goes on. In spite of recurrent alarm on the subject, there is no apparent check in sight, nor does there seem any likelihood of one in the foreseeable future. The prospect obliges the closest possible agricultural re-examination of those areas where there is still land to spare. Though we can naturally assume that such areas are poorer than those already in full cultivation, that does not oblige us to write them off permanently.

One such area, the French Niger Delta, was described in World Crops, 1953, **5**, 273. I have recently visited another district whose open country, with occasional sparse trees, reminded me forcibly of the Niger area. In the distant hinterland of British Guiana are the savannahs of the Rupununi River, divided into two by the Kanuku Mountains. These savannahs are cut off from the coast by a belt of forest which makes access difficult, and the rivers, the old travel route, have tricky rapids to negotiate. The country is, therefore, only accessible by air from the more populated coast, and the recent introduction of regular interior air routes has begun to make this distant region better known. Air freight is now practically the only channel for all business with Georgetown. The standard charge of three pence per pound, though restricting traffic to the essentials, is not prohibitive.

These savannahs are large by English ideas. Totalling some 5,000 square miles, they are still only an off-shoot of similar larger areas in neighbouring Brazil. On both sides of the international boundary it is typical ranching country, and until recently there was more commercial exchange over the border than with the coastal capital.

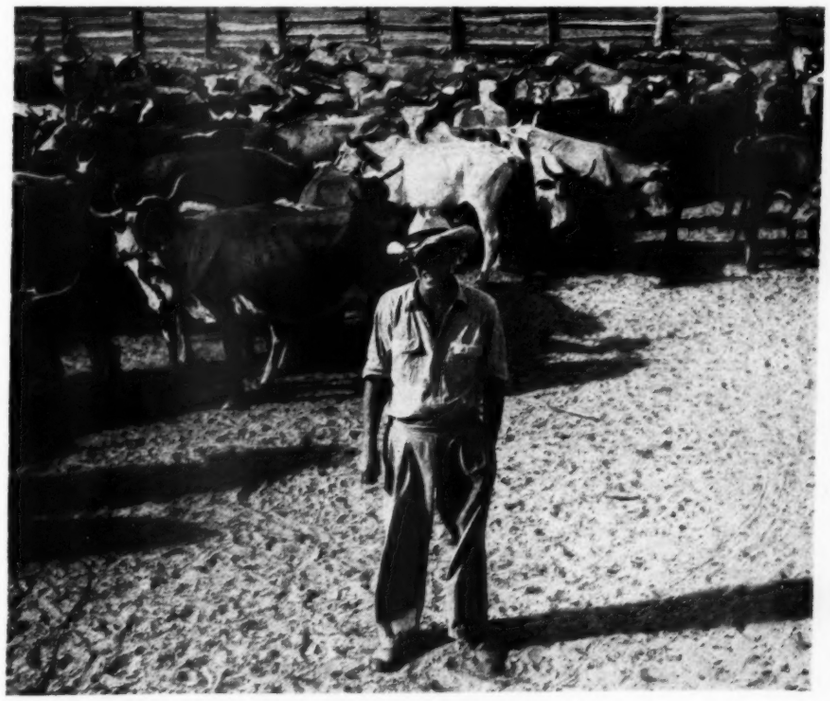
Ranching

In the 19th century this area was little explored, and its boundaries with neighbouring states ill-defined. A type of Iberian longhorn cattle, presumably introduced into South America by the early Spanish settlers, had become established. The possibilities of serious ranching activities were seen by a group of enterprising English settlers at the end of the 19th century, and a development began which has continued until today. Now, a quarter of the capital's beef supplies come by air from the Rupununi. One of the best known of the early pioneers was H. P. C. Melville, a Scot, who made his mark on the country in more senses than one. Marrying into a local Amerindian tribe, he left descendants who are among the more important landholders in the north savannahs, where there are several individual holders. In the south Melville sold out his interests, in 1919, to the Rupununi Development Company, They now hold the whole area; it is believed to be the largest ranch in the world, exceeding even in area the famous King ranch in Texas.

The soil of the savannahs is clearly poor. Early ranching enthusiasm had tended to some over-stocking, but the low figure of 15 head per square mile is now accepted as reasonable.

Cattle range freely, and at a half-yearly round-up, in old-fashioned cow-boy style, they are branded, culled for slaughtering, and the unwanted bull-calves castrated. Steers are usually killed at three to four years old. The population of the whole area is mainly native.

Amerindians adapt themselves well to a cow-boy life. Their villages are usually residential only, all cultivation being on the better soil of the mountain foothills, often many miles away from the homestead. A little cotton is grown for hammock-making, and the only cash crop is tobacco, which is used in blends with imported leaf in George-



Cattle bred on the Rupununi savannahs supply a quarter of Georgetown's (the capital of British Guiana) meat supply

town factories. The Imperial Tobacco Co. have recently sent an expert to study the possibilities both of enlarging the cultivated area and of improving the curing methods in use.

Improvements

That the soil is poor is self-evident. That nothing can be done with it, or that there are not pockets justifying more intensive cultivation, need not, however, be assumed. The resources for a detailed study have not been available until recently, but now a proper soil survey is in progress, with the assistance of a grant from Colonial Development and Welfare Funds. The generally sandy nature of the soil suggests a suitability for groundnuts, which some ranchers are trying with success. It can be taken for granted that the pastures would respond to heavy manurial dressings, as is already seen in the enclosed paddocks of the homesteads. But the economics of wide-scale savannah fertilisation is another matter.

A debatable point is the regular grass burning which the Amerindians have always practised. They claim that in burning the old grass they are encouraging new growth, and that ticks and reptiles are destroyed in the process. More imformed opinion seems to be uniformly against the burning but has not so far succeeded in stopping it. Perhaps a compromise, in which some controlled burning replaces the present indiscriminate firing, might finally be arrived at.

The other line of possible improvement concerns the type of stock kept. Zebu–Hereford hybrids were first introduced about 30 years ago, and have effected some improvement. The results of free mating with the original longhorns have, however, given a very variable stock, on which little scientific selection has so far been done. All that, it is hoped, will be changed in the future. A Government livestock farm in the area, also financed by Colonial Development and Welfare Funds, is making its stride, and two new pedigree Hereford bulls have just arrived in British Guiana. It is also hoped to make a trial of Santa Gertrudas. This famous Texan breed of Zebu-Shorthorn hybrids could quite easily be the right answer to the stock problems of the Rupununi savannahs. These attractive, wide-open spaces are a challenge to all the resources of modern agricultural science. They cry out for development.

SUBSISTENCE FARMING IN THE RUPUNUNI SAVANNAHS

EDWINA MELVILLE

The Amerindians of the Rupununi savannahs contrive to make a living from the poor ranching soil and are completely independent of imported supplies. The main crop is cassava. Maize, sugar-cane and cotton are also cultivated.

AS explained in the preceding article the Rupununi savannahs of British Guiana comprise extensive areas of poor ranching soil. The Amerindian inhabitants are maintaining a primitive type of subsistence farming which, with local variations, may be considered typical of large parts of South and Central America.

The farmer's plot is usually known as his ' bush '. He will naturally like it as near as possible to his homestead but, in the Rupununi, this is not usually very near. Villages, spaced irregularly in the savannahs, have mostly been sited on high spots to secure immunity from flooding in the wet season. Either ringing the savannahs or rising in them are the outcrops of volcanic mountains. High rainfall ensures that the actual plains are leached fairly quickly of soluble plant nutrients. The same rainfall accumulates good workable material at the hill bases, and here, where the hill merges into the open plain, are the cultivated bushes.

Five or even 10 miles is regarded as an acceptable trek between home and farmland, on foot if necessary, though on a bullock, a donkey, or even a horse, if one has one, by preference. Alternative cultivable sites are provided by small areas besides the rivers, or by abandoned corrals until the residues of animal droppings are worked out.

Crops

A typical Amerindian peasant is completely independent of imported supplies. His primary crop is cassava (*Manihot utilissima*), a ubiquitous plant with manifold uses. Land preparation usually consists in cutting down and burning the bush, which on land good enough to be worth cropping re-establishes itself very quickly. After burning, usually carried out at Easter time, the end of the dry season, little is done in the way of land preparation. Small mounds are made up by hoe, and several 10-in. stick lengths are set out in each mound. Cassava is vegetatively propagated, and may be left from one to three years before replanting, according to type. The sweet cassava is quicker in maturing, but normally it rots if not used within a year. The bitter variety is longer lived.

The tuberous root is the part used, and it can be put to many uses, according to the ingenuity of the consumer. Ground to a flour it can be baked into cakes, and even European palates quickly adapt themselves to a food which is as important in its region as wheat to a European or rice to an Asian. Farine, so called, is prepared by grating the pulp of the soaked root, squeezing out the moisture in a press, and then roasting on a hot pan.

The final product resembles a proprietary breakfast food, and is as tasty, whether eaten dry, with meat, or moistened. In the latter case a cassava farine porridge can be made, and eaten with milk.

The extracted juice of the cassava root, if allowed to set, forms the well-known tapioca, and is also the base of

the fermented brew known as *parakari*. This is the Amerindian's beer, and a party is generally held at cutting time, when it flows freely, much as in a traditional European ' harvest home '.

Second in importance to cassava is probably maize, or, as it is the fashion to call it in the New World, corn. The flint form is grown as stock-feed, or for sale to ranchers, but the softer dent maizes, easier to grind, are preferred for home consumption.

A few hills of sugar-cane, for home crushing, complete every man's standard articles of diet. A few trees of kidney cotton (*Gossypium barbadense* var. *brasibense*) are always included in the bush for the women to spin, everyone making their own hammock. Although the lint of kidney cotton is coarser than that of the free-seeded forms, it makes a sufficiently strong yarn, two-folded, and appears to be preferred principally because of the ease of hand-ginning.

For vegetables there are yams, sweet potatoes, and pumpkins, and the plantain, a cousin of the banana, is also extensively used as a vegetable in the form of fried slices. Hot pepper makes an important condiment to add to the cassava. The Amerindian is very fruit-conscious, the need for vitamins clearly asserting itself. The commonest cultivated fruit is the paw-paw, which here grows to enormous size, fruits being seen as large as a rugby football. Pine-apples, water-melons and bananas add variety, and are supplemented by many wild fruits found in the mountains.

Such subsistence farming has probably been more or less standardised for centuries, perhaps even for millenia. The only innovations are likely to be new vegetable forms, introduced by the more sophisticated ranchers, and hill rice, with which experiments are being made.

Pests

The fight with pests and marauders is of course as unchanging as the cultivation. The vicious cabouri fly (*Simulium* sp.) is perhaps more of a nuisance than a source of loss, though its disturbing effect could be said to have an economic influence on the efficiency of work. The coushi ant (*Atta* sp.) eats anything and everything, the more succulent cultivated crops being apparently more acceptable than the native flora. Wild pigs, tapirs, and agoutis are among the mammals that crops have to be guarded against; little monkey hands can pick a corn ear as well as a human hand, and the only satisfactory way to solve the problem of the birds' liking for hill rice may be to plant enough for all comers.

It is a life where the fittest survive. Luckily there are abundant fish in the rivers to supplement a vegetable diet.

This method of transport is commonly used on the Rupununi savannahs

Photos: Government Information Service, British Guiana

N.I.A.E.

The National Institute of Agricultural Engineers at Silsoe, Beds., recently took delivery of the thousandth pH meter of its type to be manufactured by W. G. Pye and Co. Ltd., Cambridge. It is well known that the N.I.A.E. has done very valuable work in the development of more efficient farming machinery, and, in fact, the new pH meter will be used in the examination of the effects of combine harvesting on grain. The development of new machinery involves not merely mechanical design but thorough investigations into the effects of these machines on farm products.

Mr. Bason of W. G. Pye and Co. Ltd. pointing out the simple controls on the pH meter to the assistant in the N.I.A.E. laboratory

Japanese Developments

The Kiso Development Corporation, Japan, was formally set up late last year. Its task will be to develop electric power and irrigation projects on the Kiso River in the Aichi Prefecture. The Corporation will be financed with loans from the International Bank and with the yen proceeds from the sale of U.S. surplus agricultural products.

NOTE ON AGRICULTURE IN LATIN AMERICA

The 'Economic Survey of Latin America, 1954', prepared by the Secretariat of the United Nations Economic Commission for Latin America, has recently been published. The Survey draws attention to the symptoms of weakness in the rate of Latin America's economic development in recent years. The chapter dealing with agricultural development indicates that, apart from a few encouraging symptoms, agriculture is not excluded from this general censure.

DURING the 1953–54 farm year agricultural production in Latin America rose by 2.5% above the preceding year and thus almost equalled the rate of population growth. Latin America's share in world agricultural production, compared with five years ago, does not show any striking changes —wool, sugar and coffee are smaller, wheat and cacao slightly larger, and rice and cotton remain unchanged. *Per caput* production remains low—below prewar levels.

Since the second world war agricultural production in Latin America has been directed more towards the home than the export market. Production for domestic consumption, which accounted for only about one-half of the prewar aggregate, has since that time monopolised most of the increases and in recent years has absorbed almost two-thirds of the total.

The reason for this is to be found in the policies adopted by the various governments to increase the supply of scarce agricultural commodities by developing domestic production with a view to replacing exports or to meet growing consumer needs. In most cases their efforts have proved successful. Production has expanded more rapidly in countries with a deficit than in those which export agricultural products. With sugar, for example, production by formerly 'deficit' countries has risen by 42%, whereas there has been a decline of 3.5% in production in the sugar-exporting countries.

There is an obvious contradiction in the development of Latin America's agriculture as a whole. Some countries have had to restrict production because of difficulties in selling their exportable surpluses and others have been able to cut down imports owing to their own larger domestic supplies. Some countries have even advanced from an importing to an exporting position.

Some export trade has been lost owing to the falling away of traditional markets—the export of linseed is a typical example—but, generally speaking, the export decline has come about because of the pressure exerted by domestic demands upon a stationary level of production. The most obvious case is that of meat. During the 'thirties the region was amongst the principal exporters of the world, but because the rate of increase of livestock production was lower than that of population increase a larger share of the available meat had to be devoted to domestic consumption. Argentina, Brazil and Uruguay have all been affected by this development.

The decline in several of the main traditional exports of Latin America's agriculture has not been offset, except in isolated cases, by a corresponding increase in the production of other agricultural commodities which might find foreign markets. Fruit and vegetable exports have begun in recent years, but the expansion of the trade has been limited by lack of refrigerated tonnage and its high cost.

Broadly speaking, external demand for the region's agricultural products has been somewhat inelastic compared with the growing domestic demand which has closely followed the rise in income level brought about by industrial growth.

Preparing the soil for a coffee plantation in Brazil—new fertilisers are being used

Agricultural trade balance

Latin America as a whole is a net exporter of foodstuffs, but the situation created by the pressure of domestic demand has given rise both to greater food imports and to a decline in exports. Data on the 10 Latin American

countries* which account for 80% of the aggregate exports show that food exports declined in 1954 in relation to the preceding year and reached a point far below prewar levels. Excluding Argentina, Cuba and Mexico, where food imports have tended to decline, and Uruguay, where they have remained stationary, the Latin American countries have had to resort to imports to bridge the growing gap between domestic supply and demand which local agriculture is unable to meet. An absolute deficiency has not yet been reached, but the figures show a greater dependence on food imports, which contrasts sharply with the trend towards self-sufficiency.

Limitations and possibilities

Governments have sought to remedy a position which is paradoxical for a region where more than half the actively employed population works in agriculture. Corrective measures have consisted mainly of guaranteed prices, technical assistance, credit facilities, government investment in irrigation and transport. Despite some success achieved in these fields, much still remains to be done.

The main limiting factors are the lack of capital and technical knowledge. Census data and available estimates on land-use indicate that there is sufficient arable land in the region—already under cultivation or which might be farmed without any substantial capital outlay—to meet current and future demands. The problem is how to make better use of that land. Statistics on land-use in Latin America are very incomplete, but they do provide some idea of the extent of arable land and the use made of it; organised agricultural exploitation is reported to affect only 38% of an estimated 1,380 million ha. of productive land. Only 17% of the land exploited is devoted to crops or artificial pastures, the remainder being comprised of low-yielding natural grasslands. These percentages compared badly with almost all other regions—even including Africa.

Manpower is plentiful. Agriculture constitutes, in general, the reserve from which manpower is drawn for other activities. But productivity is low. This fact and the poor use of agricultural land are the basic causes of the present stagnation of Latin America's agriculture.

Reprinted, with permission, from World Agriculture

Photo: Brazilian Government Trade Bureau, London

* Argentina, Brazil, Chile, Colombia, Cuba, Ecuador, Mexico, Peru, Uruguay, Venezuela.

Appreciation of a Contemporary

Agricultura—Revista Agropecuaria is the full title of a Spanish monthly periodical with which WORLD CROPS has had an exchange arrangement for some years. A complimentary note on WORLD CROPS, published in the October, 1955, issue of the Spanish periodical, has given rise to the idea that readers of these columns might be equally interested to be introduced to this leading Spanish agricultural journal.

Now in its 24th year, and therefore approaching the 300th number, *Agricultura* is considerably older than our own journal and has built up, over the years, a sound tradition of good first-hand publicity and world-wide reporting. The October 1955 issue might serve as a typical example of the coverage afforded.

In common with most technical journals in Latin countries, and in contrast to current British practice, editorial comments are mostly confined to a single subject. In this particular issue, editorial comment is very appropriately centred on the forthcoming centenary celebration of the creation of the profession of agronomical engineering, an event which had tremendous repercussions on the scientific and technical development of agronomy. To *Agricultura*, which has been founded and directed by agronomic engineers since its foundation, the subject is naturally appropriate.

Pride of place among the original contributions to this particular number is given to an interesting article on the geographical origin and subsequent spreading of world crops by G. Garcia-Badell. Accompanied by maps of the world and Europe, the article attempts to trace the origin, as far as data are available, of all the important plants cultivated by man for nutritive or industrial purposes.

There follows an article by José Pané Mercé on the genetics of wheat crops, dealing with the results hitherto obtained from experiments carried out, since 1946, by a genetics research team of the Agricultural Co-operative at Guissona.

The wide range of subject matter covered by the journal is well illustrated by such subjects as electric power tariffs, soil erosion and preservation in the Huelva Province, and farmland taxation problems.

Turning to items of general information, the journal covers the latest events of topical interest in the national and international spheres. At home, reports of relevant new legislation, on the issue of new official decrees and regulations; new movements of personnel in the agronomic profession; visits of foreign experts; demonstrations of agricultural machinery; news of prize contests for technical research; up-to-date reports of the crops position in the provinces; competently analysed market news. Abroad, news and appraisals of topical events such as the atomics exhibition at Geneva, the meeting of the European Hops Committee in Belgium, the F.A.O. meeting in Rome, the International Antibiotics Congress in Rome.

A special feature of *Agricultura* is an extensive 'Question and Answer' service, which, spread over a number of pages, bears witness to the popularity and alertness of the journal.

Agricultural Improvement Council

Prof. E. G. White, PH.D., F.R.C.V.S., Professor of Veterinary Preventative Medicine in the University of Liverpool, has been appointed a member of the Agricultural Improvement Council for England and Wales to fill the vacancy created by the death of Prof. F. Blakemore, D.V.SC., M.R.C.V.S., D.V.S.M.

Agricultural Crops in Hawaii - II

ALAN THISTLE

(Division Director, Board of Commissioners of Agriculture and Forestry, Territory of Hawaii)

The second part of this article presents a survey of the pineapple industry and a general appraisal of the diversified agricultural industry in Hawaii. The author sums up the position by saying that the production of sugar-cane and pineapple is a major economic force in Hawaii, but that steps are now being taken to diversify her agriculture in order to supply the local market and she must also develop more crops and agricultural products for export.

General

THE pineapple industry is approximately 50 years old. It has grown from an annual commercial pack of about 2,000 cases in 1903 to approximately 30 million cases at the present time. The present annual value is over $100 million. The canned and fresh frozen product is no longer a luxury item on American menus.

Pineapple is produced on five of the principal islands over a total of approximately 73,000 acres. There are nine pineapple companies operating 13 plantations, the production from which is practically all for canning or quick-freezing. There are also numerous small individual planters who raise crops for the fresh-fruit market, both for local consumption and for export to the continental U.S.

Labour

The plantations and canneries employ about 10,000 persons on a year-round basis. Approximately 13,000 additional persons are employed during peak harvesting and canning periods. Wages are comparable with those of the sugar industry and are among the highest paid to agricultural labour in the world. Regular male employees average approximately $3,000 per year on the plantations and approximately $3,500 in the canneries.

Research

Like the sugar industry, the pineapple industry also has its own agricultural research and experiment station, the Pineapple Research Institute. It is supported solely by the nine companies on a budget of over one million dollars per year. This organisation conducts field and laboratory research for improving (*a*) agricultural machinery; (*b*) cultural practices; (*c*) weed, insect and disease control; (*d*) genetics; (*e*) by-products; and (*f*) long-range weather forecasting. The last project is in co-operation with the H.S.P.A. and the Territorial Cattlemen's Association.

There is considerable use of machinery and labour-saving devices both in the fields and in the canneries.

Land preparation and planting

As in sugar-cane cropping, pineapple, for the most part, is raised year after year on the same land, but land preparation is a much more elaborate operation than in sugar-cane fields. The land is ploughed and then harrowed many times to incorporate earlier crop residues with the soil and to kill weeds and germinating weed seeds. The soil is then chemically fumigated for nematode control by equipment mounted on tractors. Most of the fields which have any appreciable slope have been bench terraced in recent years to control soil erosion.

After the land has been smoothed by land planes, the fields are laid out with roads 100 ft. apart, usually on the contour. These roads are used for practically all future crop operations. Mulching paper is laid down in strips between and parallel to the roads, forming the future pineapple rows. The mulch paper is for moisture conservation and weed control. It is laid by a machine which also deposits a ridge of soil over each side edge of the paper. The paper is about 3 ft. wide and accommodates two rows of pineapple plants. Planting is by slips selected by hand from healthy, insect-free fields of growing pineapple plants.

The mulch paper is marked at time of manufacture to show the proper plant spacing. Planting is a hand operation—the men push a hole in the paper with a sharpened tool with one hand and then push a plant slip through the hole into the soil beneath with the other hand.

Fertilisation

Extremely high amounts of nitrogen, potash and phosphoric acid, generally from inorganic sources, are applied at intervals throughout the crop cycle. Some companies place a pre-planting application under the mulch paper. Other applications are applied as foliage sprays from low-flying aircraft or from ground rigs, which travel on the field roads and have 50-ft. booms extending out over the growing crop. Iron sulphate is also applied at intervals as a foliage spray. There is some use of the ' trace elements ', such as zinc, boron etc.

Irrigation

In most places in Hawaii pineapple is planted at elevations above the irrigation supply systems developed by the sugar industry. Until recent years pineapple was considered an unirrigated crop suitable for planting in areas receiving not less than 35 in. annual rainfall. The drought years of 1951–52 and 1953 forced most plantations to devise various sprinkling methods and systems. Comparatively

small amounts of water applied at the proper intervals now appear to be highly profitable.

Weed control

The hormone herbicides 2,4-D and 2,4,5-T cannot be used in pineapple fields without serious damage to the crop. Weeds are controlled between the mulch paper strips, along field edges and roads by other chemicals, such as CMU, dinitro and substituted urea compounds, sodium TCA and activated, aromatic oil emulsions or combinations of these materials. They are applied from spray rigs (see ' Fertilisation '). In some instances a man rides halfway out on the boom to regulate the nozzle spacing between the rows. Some plantations use ' blow torch '-type weed burners mounted on wheel-type tractors in addition to chemicals.

Insect control

Unlike the sugar industry, the pineapple industry's insect pests are not under good biological control. Hundreds of thousands of dollars are spent annually for the control of thrips, mealybugs, ground beetles and ants in addition to soil fumigation at time of planting. Insecticides and methods of application vary between companies. Many are using the newly developed organic phosphates applied from ground spray rigs or from low-flying aircraft.

Disease control

The most serious pineapple disease in Hawaii is pineapple wilt, caused by a toxin, with certain weeds as alternate hosts, and with a mealybug as vector. Good insect and weed control appears to keep this disease in check.

Harvesting

Two or three harvests are picked from one planting. Harvest time may be controlled to some extent by the time of year of planting and by the use of growth-regulating hormones, but weather appears to be the principal factor involved. Most of the fruit is harvested during the period May to September.

The fruit is hand picked by men or women walking behind an ' endless belt ' carrier boom, which extends out 50 ft. over the crop from the field road. The carrier boom is powered and is moved forward at right angles to the rows by large wheel-type tractor equipment constructed for the purpose. Fruit is picked at a stage of maturity governed by the stocks of fresh fruit on hand at the cannery. This may be anywhere from quarter-ripe to fully mature. Colour is a poor indication of ripeness and when maturity is in doubt it is determined by thumping the fruit.

A machine lays mulch paper before pineapple planting. White lines on paper indicate plant spacing. Each strip accomodates two rows.

Transportation

Harvested fruits are deposited loose in large wood and metal bins, which are loaded on to and unloaded from large diesel trucks and trailers by finger-lifts and high-lifts.

The fruit is dumped into storage bins at the canneries and is carried past grading and sizing tables to machines which prepare the various styles of pineapple demanded by the market.

Marketing

Canned and fresh-frozen pineapple products are highly competitive with other canned and fresh-frozen fruit products on the U.S. mainland. The companies spend millions of dollars annually in national advertising and promotion. The companies also have a joint organisation, the Pineapple Growers' Association, which carries on an intensive programme to help stimulate the demand. Most of the pack is sold on the continental U.S.A.

By-products

In the canning process there is practically no waste. All edible parts are processed into the various styles—slices, chunks, tidbits, crushed or juice. Other parts are utilised for such products as pineapple bran for livestock feeds (from the shells or skins) and for the manufacture of citric acid, alcohol and sugar.

Diversified Agricultural Industry

General

Unlike the sugar and pineapple industries, the diversified agricultural industry, excluding livestock and poultry, is comprised of approximately 3,000 small farms. About one-half of these produce fresh fruits and vegetables for the local market. Farms range in size from 1 to 200 acres, with an average of about 20 acres. For the most part they are family units located on what might be termed ' marginal lands'. 'Marginal' because for reasons, such as elevation, location, soil condition or weather, they are not suitable for sugar-cane or pineapple production.

One of the current Territorial Government's main objectives is to provide more suitable land and irrigation water for diversified agricultural enterprise. By this means it is hoped

to broaden Hawaii's economic base as well as to make Hawaii less dependent on imported foodstuffs.

Territorial agencies

There are three major Territorial Government agencies primarily concerned with diversified agriculture:

Research.—The Hawaii Agricultural Experiment Station is a part of the College of Agriculture of the University of Hawaii. It employs scientists and specialists in various fields, *e g.* agricultural economics, agronomy, entomology, genetics, pathology, horticulture, soil and agricultural chemistry, food processing, agriculture engineering, animal husbandry, parasitology, plant physiology and nutrition. They are concerned primarily with research and operate on a budget of about $700,000 per year.

Education.—The Agricultural Extension Service, also under the College of Agriculture, employs specialists in the various agricultural sciences. They are concerned primarily with education and instruction. County Agricultural Agents and their assistants are located in or near all of the principal diversified farming districts. In addition, all rural high schools offer courses in vocational agriculture.

Regulatory.—The Board of Commissioners of Agriculture and Forestry is a Territorial Government agency employing scientists and specialists in the various agricultural sciences. They are primarily concerned with regulatory work, *e.g.* the enforcement of plant and animal quarantines, grades and standards, and the proper labelling of agricultural products and the materials used to produce agricultural commodities.

Probably nowhere else in the world has the biological control of insect and noxious plant pests been so extensively and successfully used. The importation of beneficial insects and diseases is a function of the Board of Agriculture and Forestry. Exploratory entomologists are sent to all parts of the world in the search for natural enemies of Hawaii's agricultural pests. The maintenance, conservation, protection and development of the forest reserves and watersheds is also a function of the Board.

Federal agencies

The United States Department of Agriculture maintains staffs at certain of its bureaux and divisions in the territory.

Soil conservation.—The U.S. Soil Conservation Service assists cane and pineapple planters, ranchers and diversified farmers whose lands lie within Government-organised soil conservation districts. There are 15 such districts in Hawaii governed by their own elected directors. The districts cover a total of over 1½ million acres of crop- and range-land and comprise approximately 4,000 individual farms, plantations and ranches.

Plant quarantine.—The U.S. Bureau of Entomology and Plant Quarantine's staff assists the Territorial Board of Agriculture and Forestry in servicing the fresh fruit, vegetable, cut flower, foliage and plant-propagation export industries. It also maintains a close watch on all plant material exported to lessen the risk of Hawaii's agricultural pests gaining entry to the continental U.S.

Fruitfly control.—The U.S. Oriental Fruit Fly Investigation's staff has developed agricultural commodity treatments (fumigation methods) which permit certain fresh fruit and vegetables to be exported. They have also developed lures, baits and spray treatments for the control of Hawaii's three immigrant fruitfly pests. This organisation, in co-operation with all other territorial agricultural agencies, both public and private, and the State of California's Department of Agriculture, searched the tropical world during 1949–51 for parasites and predators of the destructive fruitflies. As a result of this effort, plus previous work by the Board of Agriculture and Forestry, the fruitflies are under good to excellent control by biological means.

Benefit payments.—The Agricultural Stabilisation and Conservation Office administers the Federal Sugar Act in Hawaii. It also makes benefit payments to growers who follow approved conservation practices. In 1954 payments to cane planters for compliance with the Sugar Act totalled almost $10 million and agricultural conservation benefit payments were approximately $110,000.

Farm credit.—The Farmers Home Administration makes both short- and long-term, low-interest loans to farmers. Some Territorial Government monies are appropriated to supplement Federal amounts.

Papaya orchard—a considerable volume of this fruit is exported in the fresh state to the continental U.S.

Other agencies

The Industrial Research Advisory Council.—The 1949 Territorial Legislature created the Industrial Research Advisory Council (IRAC) and appropriated over $370,000 to it for research leading to the broadening of Hawaii's economic base, principally in agricultural endeavours. Succeeding Legislatures (biennial) have continued IRAC with appropriations amounting to a total of $950,000. Approximately 90% of these funds were granted by IRAC to agricultural agencies, both public and private, for a wide range of agricultural projects. These were for improved processing, development of mainland markets, new products, cultural practices and improved pest control. Slightly more than one-half of the Territorial funds were ' matched ' or supplemented by the grantees or by funds appropriated under the Federal Research and Marketing Act. Funds have been utilised for research as well as for the practical application of acquired knowledge.

The 1955 Legislature incorporated the aims of IRAC with another agency, the Territorial Planning Board (concerned with land usage), under the name of the Economic Planning and Co-ordination Authority. The new agency has as an appropriation $400,000 (for two years) and has been given much broader powers than either of the two agencies it replaces. Under the new law emphasis appears to be toward the development of small manufacturing industries, but agricultural research and development are not entirely overlooked. At the time of writing members of the authority have yet to be appointed. The direction the new agency takes will, no doubt, depend on such membership.

Produce Information Exchange (P.I.E.).—This organisation is a non-profit corporation recently activated with the primary objective of bringing diversified crop production more in line with demand. The P.I.E. is unique in that it is a ' vertical ' organisation, the membership and leadership being composed of all segments of industry involved—including producers, wholesalers, processors, exporters, importers, retailers and consumer groups.

The city of Honolulu and the military forces stationed in Hawaii are the principal market for diversified agricultural products. It is called a 'pocket' market and over-production or excessive importation of any particular commodity usually forces the selling price below the cost of production. Only a few items may be exported to other markets and then only after fumigation treatments to overcome quarantines. The P.I.E. has made an excellent start toward equalising supply with demand through the exchange of information relating to advance planting, importation plans and future requirements.

Young pineapple field. Note portable pipe for overhead irrigation in the middle distance

Fresh fruits and melons.—Production of fresh fruits, other than pineapple for processing, amounts to approximately 30 million lb. per year with a wholesale value of approximately $2 million.

The export volume of fresh papaya and fresh pineapple has more than doubled each year since 1947. Other fruits and melons produced for local consumption are bananas, water melons, avocados, mangoes and small quantities of various other tropical- and temperate-zone fruits and melons.

There is a wide interest in the production and processing of passion fruit for export. Hundreds of acres are being planted to this vine crop. It is grown commercially on trellises. The natural juice is diluted with water to make a very refreshing drink and drink ' mixer '. The juice is also receiving wide acceptance as a flavour for ice creams and sherbets in mainland markets.

There is also considerable interest in the commercial production and processing of guava. At present there is a small export business in processed guava products based on production from wild, uncultivated guava shrubs. The guava is classified as a noxious plant by the livestock industry and is the principal plant species on hundreds of thousands of acres in the territory. There is also much use made of the guava by the general public in home canning and processing for family use.

Fresh vegetables.—The wholesale value of almost 45 million lb. of fresh vegetables produced primarily for the local market amounts to more than $4 million per year. Principal vegetable crops in year-round production are snap beans, broccoli, various types of cabbage, carrots, cauliflower, celery, cucumbers, daikon (giant radish), egg-plant, lettuce, onions (dry and green), peas, peppers, potatoes (Irish and sweet), tomatoes and yams.

Nuts.—The acreage planted to macadamia nuts has been increasing steadily. The wholesale value is approximately $200,000 (in-shell basis) at the present time. There appears to be a considerable future for this crop as an export commodity.

Rice.—The volume and value of rice produced locally has steadily declined. Current wholesale value is only slightly more than $100,000.

Taro.—Taro is produced primarily for the manufacture of ' poi', which is still an important item in the diet of the Hawaiian. Value of the product before milling is about $500,000.

The Coffee Industry

Coffee is the third largest agricultural product offered for export. Annual value is in excess of $6 million at current prices. Most of the production comes from comparatively recent, weathered lava flows in the Kona district of the island of Hawaii. Kona coffee commands a premium price on the U.S. market because of its aroma. It is used for blending with coffee produced elsewhere.

Unlike sugar and pineapple production, practically all the coffee is raised on small farm family units of 5–10 acres. Labour other than the farm family is employed only during peak harvest periods. Yields are very high, averaging approximately 2,250 lb. per acre (green basis).

In much of the coffee area machinery cannot be used because of the rocky soils and the topography. Chemicals are used for weed control and periodically the trees are heavily fertilised. Pruning and harvesting are by hand. Coffee does not ripen uniformly and the trees are visited by the pickers three to five times during the fruiting season. The schools in Kona adjust the summer vacation period to coincide with the coffee harvest. Students are a major source of labour for harvesting.

The coffee berries are carried in burlap bags out of the orchards by men, women, children and pack animals. Most growers dry their own coffee in the sun. Large drying trays are mounted on wheels so that they may be rolled under cover during the frequent rains.

There are a number of small and a few large coffee mills where the growers may have the dried cherries pulped, cleaned and graded. Only the coffee that is used for local consumption is roasted and ground in Hawaii. A considerable portion of the coffee consumed in Hawaii is imported because Hawaii's coffee is more valuable as a blend.

Conclusion

The production of sugar-cane and pineapple is a major economic force in Hawaii. It will probably remain so for a long time. However, with sugar there are a number of plantations on which production is no longer profitable because of the increasing demands by labour and other rising production costs. With pineapple, production is meeting ever-increasing competition from other processed fruit products in U.S. markets. In the past three years the companies have experienced considerable difficulty in disposing of their total packs. Hawaii knows it must diversify its agriculture. Although great strides have been made in this direction, the surface has hardly been scratched. Hawaii must produce more of the agricultural commodities used locally and thereby keep more of her dollars at home. Hawaii must also develop new crops and agricultural products for export.

Photos: S. Tanaka

Ninth Dalton Lecture

' There was no scientific basis for assertions that fertilisers injured the soil and the health of crops, animals, and human beings. The ills sometimes attributed to fertilisers existed before they were discovered and are rife where they have never been used ', commented Sir William Ogg (Director of Rothamsted Experimental Station), when he spoke on ' Chemistry and Crop Nutrition ' as the subject of the Ninth Dalton Lecture of the Royal Institute of Chemistry, at the Town Hall, Manchester.

In his defence of fertilisers he also made the point that scientists had contributed largely to the 55% increase in food production in Britain since 1939, and that fertiliser consumption on the farms had trebled. British farmers applied annually £20 million worth of nitrogen fertiliser alone to their crops.

These fertilisers are vital now that the supply of the older manures is quite inadequate.

Other important plant nutrients include calcium, magnesium and sulphur and also the ' trace elements ' such as copper, zinc, boron, molybdenum etc. Only a few ounces of these trace elements are needed for each acre of crop.

Some soils cannot supply even a few ounces and produce very poor crops, *e.g.* large areas of South Australia which were once worthless have been made fertile by adding half an ounce per acre of molybdenum. Excess of certain elements can be harmful; on some pastures, for instance, livestock suffer from a scouring disease ' teart ', owing to an excess of molybdenum in the soil and consequently in the pasture.

Clay and humus

Referring to the part played by the clay and humus of the soil in crop nutrition, Sir William said plant nutrients were stored in them and the ease or difficulty of cultivating the soil depended on them. Much work was being done at present on identifying their chemical constituents and determining the amounts present, discovering the mechanisms by which they played their part, and how to use their favourable properties. Experiments were also being made on how to limit the unfavourable properties of clay and humus, such as that of holding on so strongly to various plant nutrients that plants could not utilise them.

In average conditions, only 20 to 25% of the phosphates applied to a soil is recovered by crops in the first 12–24 months after application. These ' fixed ' nutrients become very slowly available; barley crops at Rothamsted are still responding markedly to phosphates applied over 50 years ago.

Sir William concluded by saying that all agricultural scientists concerned with the water requirements of crops owed to John Dalton the first clear ideas about the nature of the evaporation processes, and modern work on this subject rested on the foundation Dalton laid.

Lord Reith Reappointed C.D.C. Chairman

The Colonial Office announces the reappointment of the Right Hon. The Lord Reith, G.C.V.O., G.B.E., C.B., T.D., to be Chairman of the Colonial Development Corporation for a further period of three years from 1 April, 1956 to 31 March, 1959.

The reappointment is also announced of Mr. Hubert Nutcombe Hume, C.B.E., M.C. to be Deputy Chairman of the Corporation for a further period of three years from 1 April, 1956 to 31 March, 1959.

Czechoslovak Imports

Since 1950 the Soviet Union has been Czechoslovakia's biggest supplier of agricultural machines and tractors, says the Slovak trade union newspaper, *Praca*.

In 1955 Czechoslovakia imported 1,027 agricultural machines from the Soviet Union. Of these, 845 were combines of the type S-4. Czechoslovakia also received 1,040 DT-54 tractors, 700 KDH-35 cultivation tractors, and hundreds of other agricultural machines.

The 'Track-Marshall'

Our attention has been drawn to the fact that the caption appearing under the illustration at the top of p. 92 of the February issue should have read 'The Track-Marshall diesel crawler tractor. . . .'

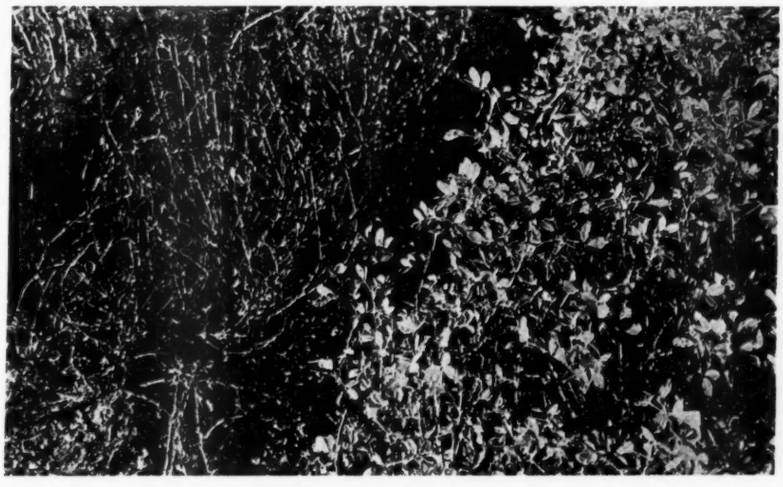
The publications dealing with the Colorado beetle and San José scale in Europe in 1954 were published by the European and Mediterranean Plant Protection Organisation and not by OEEC as noted in our February issue.

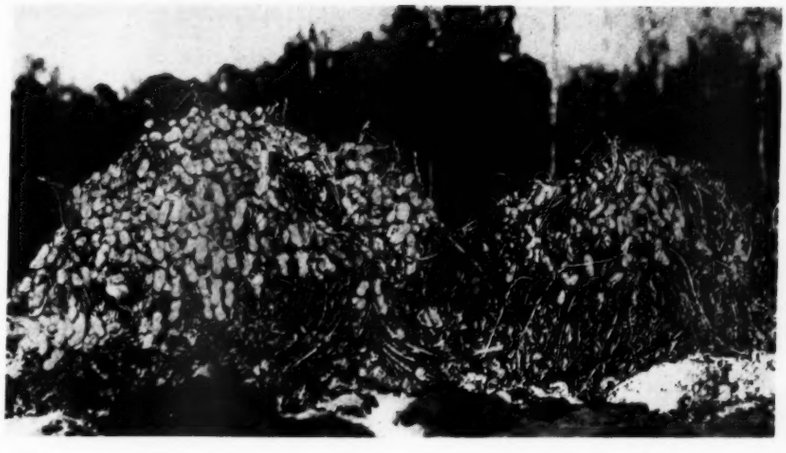
Technical News

Manufacturing Chemist for March will include an article on 'Animal Feed Additives' by J. A. Wakelam.

The contents of *Food Manufacture* for March will contain articles on 'Fruit Pulp Manufacture — Operations at Kent Factory'; and Microscopical Technique for the Food Analyst—I' by S. M. Charlett.

Among articles appearing in the March issue of *Chemical & Process Engineering* is 'Effluent Disposal Problems in the Chemical and Allied Industries', by M. Lovett, B.SC., F.R.I.C., F.INST.S.P.





Peanuts and Atomic Radiation

These photographs tell the story of the North Carolina State College's experiments with peanuts and atomic radiation (see Editorial Comment, February, p. 51). (Above) Plants harvested at the end of the experiment were free from leaf-spot disease, bore 30% more peanuts and had pods which make mechanical harvesting easy. (Centre) Two rows of peanut plants planted side by side. One (left) grown from untreated seed has been attacked by leaf-spot disease, which has stripped the plants of their leaves. The other row, grown from irradiated seed, was completely unaffected by the scourge, (Below) Another comparison: The plant on the left, again grown from treated seed, produced nearly one-third more peanuts than the untreated plant on the right.

Photos: U.S.I.F

NEW PUBLICATIONS

Money at Interest

By Allan G. Bogue. Pp. 293. London: Oxford University Press; New York: Cornell University Press. 1955. 32s.

This book is concerned with the role land mortgages filled in farm finance in the Middle West of the U.S.A. during the latter three decades of the nineteenth century—a period of extensive pioneering in that particular area and one when the spreading tentacles of the railroads were serving to complicate the credit problem.

The moneylenders of that era continue to come in for much abuse even from professional historians, who have accepted the charges which contemporary agrarian radicals levelled against them. And novelists too, when writing of the period, still tend to equate the mortgage with disaster and the moneyman with pitiless greed.

Undoubtedly the settlers in Kansas, Nebraska, Illinois and Iowa needed capital, but what proportion of them used their land as security for loans? and where did they actually obtain their funds? who negotiated them and by what means? above all, how successful were the lenders in obtaining returns on their capital? and how successful were the borrowers in utilising borrowed funds and eventually repaying them? and what was the legal framwork within which all these transactions took place? Until the majority of questions such as these are answered in full, comment on the period should remain guarded.

Mr. Bogue does not claim to have found already the answers to all of them, but at least he is a fair part of the way there. He shows us in this essay his three principal points of departure. The first section deals with the story of the mortgage investments of a wealthy New York family over a period of 50 years. In the middle part he follows the career of an important western mortgage broker—and the final study is devoted to the position of land credit in two townships during that era.

From these researches it is fairly clear that the western mortgage was a recognised form of investment in the eastern states during the 1850s, and that by the early 1870s large corporations, such as insurance companies, as well as private investors, had sent many millions of dollars westward for investment. Mortgage brokers between the '70s and the close of the century widened the market for western mortgages, since they were able to tap the resources of eastern educational and charitable institutions in addition to the small savings of professional people. Such broking business was lucrative and competition tended to hold in check the commissions charged. Many land-mortgage companies were formed in the 1880s, but by the early '90s a large proportion of them had already failed. And whereas average rates of interest were in the neighbourhood of 12 to 17% in the mid-1870s—earlier they had been nearer 30 and 40%—by the end of the century they were down to 5, 6 and 7%.

Mr. Bogue has found much material that is new—not least the part which British investors played in Middle Western farm finance—and it is remarkable that he has managed to collate it in such an admirably compact form. The bibliography is particularly comprehensive.

PETER BATTY

Cotton Growing Problems

By Basil G. Christidis and George J. Harrison. Pp. 633. London: McGraw-Hill Publishing Co. Ltd. 1955. 63s.

The senior author of this book, who is Director of the Greek Cotton Research Institute, takes full responsibility for all the statements made in it, and the American co-author guarantees its suitability for the public there. Greek experimental data has been drawn on freely, and much of the work there is now brought to a wider public for the first time. It has been one of the most successful of newer cotton-growing countries. By world standards it must remain, however, a minor one.

At 63s. this book seems high-priced, but the main criticism is that it might have been better if the senior author had frankly written a book on ' Cotton Growing in Greece '. In aspiring to generalise the book to cover, presumably, the world as a whole, the author has made a brave attempt to cover the whole field. The immense bibliography, listed separately for each chapter, runs to 14 pages in one case. But even then the coverage is in fact scrappy. The new cotton-growing colonies in Africa receive scant mention, and the experience of the important South American growing states is hardly drawn on at all.

It may be that where cultivation, fertiliser and pest problems are concerned world experience can be generalised and effectively summarised. I am glad to see the author plumps squarely in favour of close spacings, always a pet hobby-horse of mine. But is one to take seriously the hint from a Russian experiment on overhead irrigation, which apparently yielded 800 lb. of cotton per acre against 180 lb. with normal irrigation? My own guess would have been to leave that one out. Variety problems are more specifically local. Trying to check the information given against my own local knowledge it is unsatisfactory to be told that Rivers, V46, and M51 were the leading Sea Island varieties in 1942 with no later information on the modern strains now being grown.

Similarly in Egypt Giza 32, bred and summarily dropped 20 years ago, is included among the varieties which ' appear very promising '. The wrong parantage is attributed to Karnak.

Likewise the statement is made that ' the only remaining trace of the influence of perennial cotton (in Egypt) is in the presence in the field of abnormally tall rogues, up to four metres in height '. In 30 years' experience, I never saw a plant 13 ft. high. Any unusually tall plants were always ' Hindi hybrids ' and the effect was due to interspecific hybrid vigour.

In an all-embracing work of this kind one is bound to check such statements with one's own local knowledge of an area and the lack of agreement inevitably causes one to doubt the information given on, for example, Russian varieties.

C. H. BROWN

Fruit

A review of production and trade relating to fresh, canned and dried fruit, fruit juices and wine. London: H.M.S.O. 1955. 5s.

This review was compiled in the Intelligence Branch of the Commonwealth Economic Committee.

This annual review shows that exports of fresh fruit totalled 7 million tons, or 1 million tons more than in 1952 and 1½ million more, on average, than in 1934–38. Exports from the Commonwealth were also at a high level, particularly those of canned fruit, which established a new record.

U.K. imports of fresh and canned fruit showed a further recovery in 1954, from the low level of earlier post-war years, and although imports of dried fruit were somewhat reduced, raisin and currant supplies were above average. Commonwealth sources provided 83% of the total receipts of canned fruit in syrup (as against only 40% in 1938), 68% of the fruit juice, 51% of the fresh fruit, and 20% of the dried vine fruit.

Fresh fruits

Although U.K. imports of fresh fruit in recent years have been smaller than before the war, total supplies in the U.K. have not been greatly reduced because of the increased supply of home-grown fruits. Fruit consumption in the U.K., including processed fruit in terms of fresh fruit, amounted in 1954 to 123 lb. per head, which was nearly 8 lb. more than in 1953 and almost up to the prewar figure. Consumption in Australia is now somewhat lower than before the war; there has, however, been a marked change in Canada, the 1954 figure for which was 161 lb., as against a prewar annual average of only 103 lb.

The further expansion of the international trade in fresh fruit in 1954 was largely the result of heavier exports of bananas; there was some increase in grape exports, but little change for citrus fruit and a decline for both apples and pears. The Commonwealth provided larger supplies for each of these fruits, with oranges nearly double the prewar average and bananas showing a further recovery; Commonwealth exports of apples, although heavier than in recent years, were still 30% less than before the war owing to the much reduced shipments from Canada.

The smaller trade in apples in 1954 was due mainly to the lower purchases of Western Germany, the leading market since 1951. The U.K. received increased consignments from Australia, New Zealand and South Africa, and small supplies from Canada; the apple exports of each of these countries showed some expansion, those of Australia rising to the 1938 level. World exports of oranges were maintained at the previous year's record total of 2¼ million tons, notwithstanding severe frost damage to the crop in Spain, which reduced exports by about 20%; this fall was offset by increased supplies from most of the other principal sources, particularly Israel. South African exports created a new record. Cyprus was again the second largest Commonwealth exporter of citrus fruit. Although U.K. purchases were reduced to some extent, and were well below those of 1938, the imports of France, Western Germany, the Netherlands and Sweden all showed further increases to well above their prewar levels. The marked expansion of the world trade in bananas has been due very largely to increased exports from South and Central America. Jamaican exports, however, have recovered from the hurricane setback in 1951 and there has been some increase in supplies from Nigeria, Dominica and other Commonwealth sources. Although the U.S.A., by far the most important importer of bananas, has not increased its purchases in recent years, there has been a marked expansion in the imports of most Western European countries.

Dried fruits and wine

World exports of raisins and currants increased slightly in 1954 in spite of some reduction in the size of the world crops and of lighter shipments from Australia and the U.S.A., the latter being offset by heavier consignments from Greece and Turkey. U.K. purchases of raisins, though smaller than in 1953, were at the same level as in 1938, and those of currants nearly 25 per cent. greater.

World wine production in 1954, estimated at over 4,600 million gal., was somewhat smaller than in 1953, but exports were increased by larger consignments from Algeria and Spain. U.K. imports exceeded 12 million gal., the highest figure recorded since the war. Shipments from South Africa were nearly up to the peak level of 1951, but exports from Australia remained comparatively small.

REPORTS

Notes on Preparation of Illustrations. London: Biochemical Journal. 1s. 0d. This pamphlet draws attention to the cost of preparing illustrations for publication. Many authors supply drawings, which, for one reason or another, cannot be reproduced in the form in which they are supplied. The pamphlet is illustrated with specimen figures, the first illustrates many mistakes which necessitate redrawing a graph and the second shows a similar figure drawn correctly; the third shows how the redrawn figure would appear on publication. Advice is given on size, materials to be used, technique and lettering.

Caterpillar publication. A booklet entitled ' Lets talk Nuts and Bolts ', published by Caterpillar Tractor Co. Ltd., Peoria, Illinois, U.S.A., draws attention to the fact that there is a difference in nuts and bolts; a difference in quality, the type of heat treatment they receive, and the type of inspection given before use. The publication is available in French, Spanish and Portuguese.

Equipment and Method for Flue-curing Tobacco, Interim Report No. 5, November, 1955, Tobacco Research Board of Rhodesia and Nyasaland. We have received a copy of this report. It deals, in short, with the flue-curing of tobacco and gives briefly the recommended processes for curing tobacco in this manner. A detailed drawing of the curing equipment is included.

The British Council 1934–1955, Twenty - first Anniversary Report, London. 2s. 6d. This book surveys the work undertaken by the British Council during the last 21 years. An incredible number of successful programmes have been arranged by them. For instance, since the end of the second world war, the Council has arranged visits for 35,726 visitors, mainly professional people and technicians, including many who have come under United Nations or Colombo Plan schemes.

Under the Commonwealth and Foreign University exchange schemes, 160 awards were made to British, Commonwealth and foreign university professors, teachers and research workers.

MACHINERY AND EQUIPMENT

Maize Drier

A new maize-drying station was inaugurated late last year at Dax (Landes), France. It is utilising the Curran Mark III maize drier, which was designed and developed by Edward Curran Engineering Ltd., Cardiff, Wales, in collaboration with Cie Continentale d'Importation de Sud-Ouest, Bordeaux, and their associates, Societé pour le Conditionment de Maïs Français (SOCOMAF), and maize growers in the south-west region. The machine gave an output of 4–5 tons of dried maize per hour when working at a temperature of 95° C. and reduced the moisture content from 32 to 16%.

The drier has been designed on the counterflow system with interstage temperature boost (or reheat). By this system the drying is progressive, *i.e.* the wettest grain is dried at a lower temperature than the drier grain. Heat is supplied from an oil-burning furnace and the motive power required is 50 h.p.

Disk Harrow

A radically different torsion frame that gives knee action to disk gangs is featured in the new McCormick International No. 37 wheel-controlled disk harrow recently announced by International Harvester Export Company (180 N. Michigan Ave., Chicago 1, Ill., U.S.A.)

The new torsion frame is made of high-strength steel angles bolted together. In normal disking, it applies uniform down pressure that holds disks to the ground, levelling off row-crop ridges and chopping chunks of sod. But, if one of the disk gangs hits a rock or hard spot that would normally lift the entire harrow, then the torsion frame lets that gang rise individually, as much as 6 in., while the other gangs remain in the ground. As a result of this flexibility, the harrow does clean, level work and trails straight in conditions where fully rigid harrows cannot be used successfully.

The new McCormick International No. 37 disk harrow has many additional conveniences, according to International Harvester Export Company. Gang angle can be changed to any one of three positions in less than a minute by simply pulling an L-pin to angle each gang. By loosening four U-bolts, the rear gangs can be quickly adjusted side-to-side to eliminate centre ridging over a wide range of disking speeds and soil conditions. An 8-in., hydraulic, remote-control cylinder with ASAE standard mounting dimensions is installed easily without tools.

Another feature is the flat, clean-cut design of the top of the disk harrow, which enables the operator to transport such equipment as a spring-tooth or peg harrow to and from the field, on top of the platform.

The No. 37 is a heavy-duty harrow with $1\frac{1}{8}$-in. axle bolts, rugged unit-built disk gangs, optional sealed ball bearings and large weight pans.

Nine combinations of widths and disk spacings are available in the McCormick International No. 37. Widths of cut range from 8 ft. 6 in. to 14 ft. Disk spacings of 7 in., 9 in. or combinations can be obtained. All sizes are available with plain or notched 16-, 18- or 20-in. disks.

'Knee-action' gangs in this McCormick International wheel-controlled disk harrow make it trail straight for clean, level disking. Gangs can oscillate individually to follow ground contour while maintaining uniform disking action

Reusable Plywood Hogsheads

A reusable, returnable hogshead, made of a single sheet of plyboard, is reported to be aiding farmers, and men in the tobacco-packing industry, in packing bulk materials. The hogshead has no nails or bolts, can be easily assembled by merely driving a steel peg through a special interlocking hinge and disassembled by removing the peg. It may be stacked flat for shipment or storage and thus permits space conservation.

Made by the Gay-Bell Corporation, 1306 S. Main Street, Paris, Kentucky, the hogsheads are 48 in. in diameter and either 54 or 48 in. high. The plywood is fed over a special gang-saw set-up, which precision-cuts slits (stave width) between two combination hook and liner bands previously machine-stapled to the plywood.

To assemble, a workman has only to fashion a semi-circular half from one of the pre-cut shapes and stand it upright. A second part is treated similarly, and the halves are joined by driving a steel peg through a special hinge. The hoop and liner bands, which circle both ends of the hogshead, have an L-shaped tongue around the inside top and bottom of the hogshead to lock the heads in place.

The heads are ½-in. plyboard with a strong metal rim. The rim prevents damage which is likely to occur when the head is pounded into place. A packer in a warehouse presses the top into place by standing on it and using his own weight, and uses small hand tools to insert the metal-rimmed head in the hoop of the plyboard hogshead.

An example of the durability of the hogsheads, as reported, is the fact that some have been used as many as 100 times by tobacco companies. (Ordinary usage in this industry is limited to four times with stave containers.)

A problem often encountered in packing bulk goods in this type of container is compressing the material enough to save space. This company uses a portable press for prising tobacco and baling and compressing paper, rags, scrap metal or cotton. The press weighs 2,000 lb. and exerts 12½ tons of downward pressure. The hogsheads adequately withstand such pressure and about 1,000 lb. of tobacco are packed into each hogshead.

This information was provided by *E.P.A. Technical Digest* No. 214.

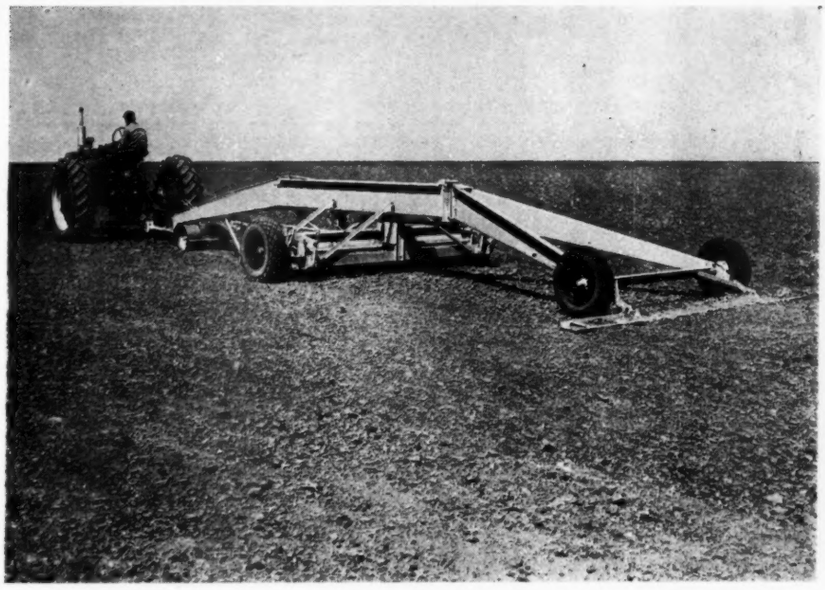
A Land Leveller

The Eversman Manufacturing Company, Curtis and Fifth, Denver 4, Colorado, U.S.A, announced a new land leveller recently. The new machine, known as the 410, is a big leveller with large blade capacity, 40 ft. long and 12 ft. 8 in. wide, and can be handled with large wheel tractors or medium-size crawlers.

The 410 combines in one machine an automatic land leveller, field plane, open bottom scraper, and a complete tillage tool for seed-bed preparation.

The cutting-blade width is 10 ft., cutting-blade depth 21 ft, blade vertical travel 16 in., and dirt capacity 2 cu. yd.

The 410 has the Eversman patented crank axle plus many new features such as: front V smoother blade for clod busting and use on heavy, dry soil; front dolly assembly for use in loose, moist and trashy soil conditions; front-end support for ease in re-hooking to tractor; screw adjustment on front truss for fast, simple regulation of dirt load in blade; rear smoother blade, adjustable to all soil conditions; high-lift blade for constructing dikes for border irrigation; finger-tip, two-way hydraulic control of blade for field planing and dirt moving.



The new Eversman Model 410 has a cutting-blade width of 10 ft., cutting-blade depth 21 ft., blade vertical travel 16 in., and dirt capacity of 2 cu. yd.

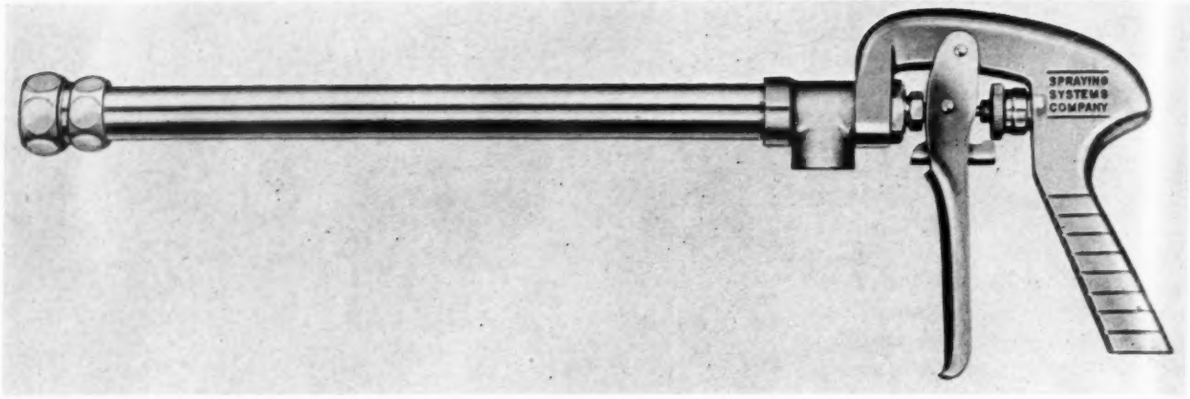
The hinged tail section of the 410 makes the 40-ft leveller handle like a small tool. Its short turning radius greatly reduces power for turning and leaves ends of fields clean and smooth. The new Eversman can be quickly converted to short form as a hydraulic scraper, and with spring-tooth attachment can be used as a tillage tool for seed-bed preparation. It is easy to transport from field to field on its own rubber-tyred wheels.

Eversman makes six additional hydraulic and mechanical models ranging in size from 9 ft. wide × 21 ft. long to 12 ft. 10 in. wide × 48 ft. long, handled by tractors from 2 plough to large crawlers. Dirt capacities are from 1 cu. yd. to 3¾ cu. yd.

Tractor Trailers

Available in rear-tipping, non-tipping or low loading form, the new David Brown/Pettit 30 cwt. trailer has

Measuring 8 ft. × 5 ft., with 15-in. sides, the David Brown/Pettit, rear-tipping trailer is of the balanced tipper type. All controls are operated from the tractor seat



The Spraying Systems GunJet No. 42 spray gun. Any type of spray from straight stream through full-cone spray to wide-angle cone spray may be obtained

been designed and built specially for use with the new David Brown 2D tractor, which was introduced at the Smithfield Show in December.

Measuring 8 ft. by 5 ft. with 15-in. sides, the rear-tipping model is of the balanced-tipper type. All controls are operated from the tractor seat, and to jettison his load the driver simply has to unlock the body and reverse a little. When the tractor again moves forward the body returns to the horizontal position. The low loader has its wheels set outside the body, which is approximately 2 ft. above ground level.

It is constructed of Malayan hardwood for durability and strength and is fitted with 8-in. brakes. It is also marketed in the 2D dairy farmer pack, which is made up of tractor, trailer, and mower.

Forage Harvester

Modifications have been made to the Silorator Forage Harvester (Silorators Limited, 103 Park Street, London, W.1). The basic machine is substantially the same as in 1955, but a new type of deflector outlet is now being supplied which is considerably stronger than the deflector used in the past, and which can now be adjusted by a hand-control fitted to the harvester, operating a wire cable which can easily be reached from the tractor seat.

An oil inlet tube is now available for screwing into the bearing housing of the Silorator unit. This tube will hold precisely $\frac{1}{8}$ pint of SAE 30 oil, and is fitted with a flip flap cover. Harvester owners are now recommended to drain the oil from this housing once every seven days and simply re-fill the tube to the brim. The oil will then percolate through into the bearing housing within four minutes, thus ensuring that the correct amount of lubricant has been added.

Another improvement is in the form of a one-piece draw-bar pin, which is designed to lock the draw bar in position but does not necessitate the use of pliers in order to extract a split pin, which was necessary previously.

A certain amount of ' choking ' has occurred on certain crops at the sides of the inlet chute to the harvester. New-type webbed fairings are now available to obviate this trouble. This completes the actual improvements to the machine, but several new items of ancillary equipment are also being introduced for 1956.

Spray Gun

The new Spraying Systems GunJet No. 42 spray gun (Spraying Systems Co., Bellwood, Illinois, U.S.A.) is designed for easier operation and greater speed in spraying. A knurled ring tripper-stop may be set for any type of spray desired. . . and acts as the limit point for opening of the trigger action shut-off valve. As a result, the valve may be closed and opened constantly during spraying, and the spray setting will always be the same and instantly obtained. Any type of spray from straight stream through full-cone spray to wide-angle-cone spray may be obtained by appropriate adjustment of the stop. For ease and comfort in continuous spraying, the trigger mechanism is equipped with a trigger lock to hold the valve open without hand pressure on the trigger.

This new GunJet model is built for use at any pressure up to 800 lb Long wearing, hardened, stainless steel orifice discs are supplied in five different capacity ranges and are replaceable and interchangeable. By replacement of cap assembly, TeeJet orifice tips of any type or capacity may also be used.

Overall design of the spray gun with its pistol-type trigger-action grip has made it a desireable and extremely comfortable unit in terms of use by the operator. Weight of the gun is the minimum possible for this type of heavy-duty unit and it is light enough to be handled with ease.

Micron Sprayers, Limited

Two new sprayers were announced by Micron Sprayers Ltd. recently. They are the Micron ' Brat ' and the Micron ' Meg '. The first, the ' Brat ', has been designed and produced for the small grower. Used either as a drift or blast sprayer this hand-barrow-type machine can be handled and operated by one man. It is suitable for spraying tree crops up to 35–40 ft. high, and can be used for ultra-low-volume spraying of all crops with a clearance between rows of 3 ft. or more. Drift applications of 1 gal. per acre of an oil-based DDT have given 100% control of the larvae of cabbage white butterfly attacking brassicas.

The advantage of the ' Meg ' is its outstanding versatility. It may be modified to make it suitable for ultra-low-volume spraying all crops through which a wheeled vehicle may pass.

The ' Meg ' is capable of blast spraying 35 acres of mature top fruit per eight-hour day with only 8 gal. per acre of water-based spray. Coconut palms are drift sprayed with 1 gal. per acre of oil-based DDT.

WORLD CROP REPORTS

PERU

Cotton

The Cotton Chamber's earlier estimate of 2,150,000 quintals (98,900 metric tons) for the 1954–55 crop looks like being confirmed. Virtually all the Tanguis is already picked and picking of the Pima is nearing completion.

Sugar

The Sugar Producers' Committee expected 1955 production to reach a new record. Their estimate is 646,000 metric tons, compared with 1954's record total of 637,621 tons.

Exports in September and October reached the high figure of 109,892 tons. Sales in the same two months totalled 104,700 tons. Total exports for the first 10 months were 364,190 tons, and internal consumption in the same period 162,000 tons.

JAPAN

Rice

The latest estimate of the 1955 rice harvest was made late last year and amounted to 387,267,687 bushels. This is 40 million bushels more than the previous record harvest in 1933 and 60 million bushels more than an average year.

BRAZIL

Amazon rubber

The recently published report for 1954 of the Banco de Credito da Amazonia shows that Amazon rubber production has fallen from 33,300 tons in 1952 and 32,800 tons in 1953 to 28,200 tons in 1954. Meanwhile, the industrial consumption of rubber during 1954 rose to 39,300 tons. Consequently, Brazil will probably have to import growing quantities of rubber each year. These trends may stimulate the establishment of a synthetic rubber industry. The Bank's report points out that the main cause of the dwindling Amazon rubber production is the exodus from the forests of the rubber tappers, who are now making their way to riverside villages and towns, where they can find less lonely and arduous work, often on projects financed by the S.P.V.E.A. (Amazon Development Authority). The Bank not only finances production and buys and sells the rubber, but also holds the monopoly for rubber imports.

Cocoa

October 1955 was an active month for cocoa exports, when some 250,000 bags were shipped abroad. Total sales of the 1955–56 crop (comprising cocoa beans and cocoa sub-products) during the first 10 months of 1955 amount to 1,623,000 bags. Estimates for the whole 1955–56 crop are set at about 2.2 million bags. Thus, only 600,000 bags are likely to be available for purchase until next April and the statistical position remains comfortable.

MEXICO

Cotton

The world cotton situation was discussed by Mexican and United States officials in Washington during the last week of November in view of U.S. Government plans to sell surplus cotton abroad at cut prices. According to the Director-General of the Bank of Mexico, Mexico was prepared to reduce the acreage under cotton, as the U.S.A. had done for some years, since they were in agreement with the U.S. Government that it was necessary to avoid the accumulation of new surpluses. This view was confirmed later by the Minister of Finance, who added that it also applied to coffee. Addressing a meeting of cotton growers, the Minister for Agriculture and Livestock stated that the area under cotton cultivation should under no circumstances be extended.

Bananas

The Mexican Government is to promote the expansion of banana growing, which has declined by 25% in the past five years principally through disease

Cereals

President Ruiz Cortines issued a statement late last year pointing out that only 5% of the acreage sown with maize and beans had been affected by the floods and hurricanes of September; the maize crop was still expected to reach 5 million tons, 10% greater than last year, and the bean crop 500,000 tons, 20% greater than last year. A million ha. would have been sown with wheat, 43% more than last year.

Sugar

The Mexican Sugar Growers' Union have asked the U.S. Government for a quota of 35,000 tons of sugar for 1956; the 1955 quota was 13,485 tons. They claimed that this quota should be raised to 100,000 tons by 1962.

URUGUAY

October was cool for the time of year with normal rainfall. Grazing camps were offering ample pasturage and livestock were in good condition. The presence of the native locust, 'Tacura', was again reported in the northern districts. Shearing was started in the second half of the month and has proceeded normally throughout the country.

Climatic conditions have favoured the development of winter crops. Wheat was promising an excellent yield with an estimated crop of some 800,000 tons. The linseed harvest, however, is not expected to compare favourably with that of 1954 owing to damage to early sowings by severe frost. Earlier rains have also prejudiced the potato crop and arrangements are in hand to import potatoes from France and Holland.

ARGENTINA

The weather in October favoured the growing crops. Maize and sunflowerseed sowings were accelerated. Grazing is good and the condition of cattle satisfactory.

The first official estimate of the area sown to wheat is 5,226,000 ha., compared with 5,937,000 ha. last year, a drop of 12%. Given average yields, production may be about 5½ million tons. The surplus for export may not, therefore, exceed 2 million tons.

The first official estimate placed linseed sowings at 677,300 ha., compared with 750,000 ha. last year, when pro-

duction of linseed was 482,400 tons. January is the critical month for this vulnerable crop.

COSTA RICA

It is predicted that the 1955–56 coffee crop will be 30 to 40% lower than the previous crop.

In order to assist cocoa growers at present confronted with low world prices, and also to increase production, the Government have granted the industry the privilege of selling up to 65% of their dollar receipts at the free market rate of exchange. This privilege is valid until 30 June, 1956.

Spec. Reg. Inform. Serv.

ISRAEL

Minister's report

Mr. Kadish Luz, the Minister of Agriculture, has outlined the agricultural policy of his Ministry for the next few years. The main aims of the Ministry of Agriculture, he said, are: to increase the area of irrigated land from 900,000 dunams to 1.4 million dunams; the expansion of industrial crops; the consolidation of young settlements, after having been initially aided by the Jewish Agency; the augmented extension of agricultural loans for working capital, thus helping to alleviate the present financial difficulties of agriculture, which threaten to restrict production.

Mr. Luz also said that he aimed to continue the policy of his predecessor and, in addition to making efforts to increase the irrigated land area as outlined above, he would pay special attention to the rentability of the various branches of agriculture with a view to limiting imports and expanding exports, *i.e.* improving the country's balance of trade.

The new Minister stated that his Ministry would devote special attention to expanding the present cotton-growing areas to 60,000 dunams during the coming year and to 200,000 dunams within the next few years, with the ultimate object of supplying all the country's domestic cotton needs, and also export requirements. He said that the area of planted groundnuts would also be enlarged considerably. Mr. Luz pointed out that the expansion of both the cotton-growing and groundnut areas would satisfy all domestic demands for fats and oils.

Mr. Luz said that a total of 3,000 dunams is the goal that his Ministry is aiming at with regard to sugar-beet. This area would provide at least the amount required by local sugar producers. Experiments and research projects have already been undertaken, he said, to discover ways and means of lengthening the term of employment in the sugar enterprises by growing sugar-beet on the largest scale possible. At the same time, Mr. Luz said, special attention would be paid to the enlargement of summer crop areas, *i.e.* of seed, to increase the locally produced supply of fodder.

Rice

The first attempt by Israel's Jewish farmers at growing rice has proved a success, with the harvest of a good crop from two experimental dunams planted in the Hula Valley by Kibbutz Manara. The two dunams, of three paddies each, in which several varieties of seeds from France were planted, yielded between 300–400 kg. per dunam.

The growing period was 105 days, which is considered satisfactory, and the rice was under water until 20 days before the harvest, when the area was drained. The successful experiment is expected to result in increased rice growing in the Hula Valley, where the climate is suitable and sufficient water is available.

ENGLAND AND WALES

Agricultural report.—Agricultural conditions in England and Wales on 1 January, 1956, have been summarised by the Ministry of Agriculture, Fisheries and Food.

Conditions were generally favourable for cultivations and sowing and work is more forward than usual. Autumn-sown crops are healthy and vigorous. The harvesting of sugar-beet is virtually complete. Livestock have done well. Winter keep has not been extensively drawn on so far and supplies are expected to be sufficient.

Weather conditions

The weather during December was changeable; the first half was generally mild with rain, heavy at times, in most areas. Colder weather with keen frost, and snow in many areas, followed and lasted for about a week, when milder conditions returned. The weather became colder during the last few days of the month, when gales were experienced in many areas and heavy rain fell over Southern England and South Wales.

Autumn cultivations

Although in a few districts rain and snow delayed operations during the latter half of the month, in most areas land worked well and good progress was made with cultivations and field work, which were generally more forward than usual. Good progress was also made with ditching and manure carting.

Conditions were favourable during the month for corn drilling and in most areas the acreage intended for winter corn has been sown.

Autumn-sown crops

Wheat has germinated well and is a promising crop.

Barley is healthy and vigorous.

Oats have germinated well and are well forward.

Rye looks well.

Beans have germinated well and are healthy and vigorous.

Potatoes

Reports indicate that generally potatoes are keeping well in clamps.

Sugar-beet

In most areas conditions for the harvesting of sugar-beet were good. Practically all the crop has been lifted; roots are clean and of good quality.

Condition of pastures

Leys continued to make growth in many areas and are generally satisfactory, although some crops under-sown this season are patchy.

Permanent pastures provided some keep during the month and in several districts have been grazed bare; dry conditions have prevented poaching.

Winter keep

Winter keep has not been extensively drawn on so far this season owing to the open weather and, given normal weather conditions, supplies should be sufficient until the spring.